Molecular survey of methane-cycling archaea in methane-soaked subsurface sediments (Guaymas Basin, Gulf of California)

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Abstract. The Guaymas Basin in the Gulf of California is characterized by active seafloor spreading, rapid deposition of organic-rich sediments, steep geothermal gradients, and abundant methane of mixed thermogenic and microbial origin. Subsurface sediment samples were selected from eight drilling sites to explore the diversity, depth range, and in-situ temperature range of methane-cycling archaea in the Guaymas Basin subsurface, using PCR amplification with general and ANME-1 specific primers for the mcrA gene. Diverse ANME-1 lineages were detected in seven drilling sites, preferentially around the methane-sulfate interface, and in several cases showed preferences for specific sites and types of sediment. Phylogenetically, most ANME-1 sequences from the Guaymas Basin subsurface were related to similar sequences from marine mud volcanoes, seep sites, and the shallow marine subsurface. Methanogenic lineages were found in three sites. The most frequently recovered phylotypes, closely affiliated with the hyperthermophilic *Methanocaldococcaceae*, were found at the hydrothermally influenced Ringvent site. The coolest drilling site, in the northern axial trough of Guaymas Basin, yielded the greatest diversity of methanogen lineages.

Importance. The Guaymas Basin has received significant attention from microbiologists and biogeochemists due to the abundance of methane in its sediments. This study has identified new ANME-1 and methanogenic lineages and phylogenetic clusters present in subsurface Guaymas Basin sediments. Our work allows for a greater understanding of 1) the diversity of methane-cycling archaea and 2) methane-cycling in the Guaymas Basin.

Keywords. Guaymas Basin, ANME-1, methanogens, phylogenetics, methane, *mcrA*