

Public Abstract

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Title: Use of stable carbon isotopes to assess anaerobic and aerobic methane oxidation in hypersaline ponds

Methane oxidation is known to play a significant role in reducing methane (CH_4) concentrations in sediments and water columns in a variety of aqueous environments. In marine systems, for example, it is thought that more than 80% of CH_4 produced is oxidized before reaching the atmosphere. However, under hypersaline conditions, little research has been performed to evaluate methane oxidation. Of the few hypersaline studies undertaken, it is unclear to what extent methane oxidation occurs, although cells of anaerobic methanotrophs have been identified in salinities up to halite saturation. The focus of this study was to investigate anaerobic and aerobic methane oxidation in organic rich microbial mats and endoevaporite crusts of hypersaline ponds. The two main study areas were the Atacama Desert in Chile and Guerrero Negro in Mexico. To track microbial consumption of CH_4 to carbon dioxide (CO_2), ^{13}C -labeled CH_4 was added to the headspace of incubation vials containing mat and evaporite slurries. After incubation for a period of time between 2 and 90 days, a portion of the biologically produced gaseous headspace was analyzed for $\delta^{13}\text{C}_{\text{CO}_2}$. If methane oxidation was occurring, the measured $\delta^{13}\text{C}_{\text{CO}_2}$ values would be more enriched in ^{13}C compared to control incubations where no $^{13}\text{CH}_4$ was added. The largest difference between $\delta^{13}\text{C}_{\text{CO}_2}$ values of $^{13}\text{CH}_4$ -containing incubations and corresponding controls was approximately +4 ‰ to +7 ‰ in anaerobic treatments of microbial mat and evaporite crusts from Salar de Llamara in Chile. The $\delta^{13}\text{C}_{\text{CO}_2}$ values for the majority of $^{13}\text{CH}_4$ treated incubations, including $^{13}\text{CH}_4$ treatments with added inhibitors, were within ~1 ‰ of respective controls. Based on the low amount of ^{13}C -enrichment in $\delta^{13}\text{C}_{\text{CO}_2}$ values, it appears that little, if any, methane oxidation is occurring in these hypersaline systems.