

TITLE: BATHYARCHAEOTA OCCURRENCE IN TROPICAL MARINE SHALLOW METHANE-RICH SEDIMENTS (SACO DO MAMANGUÁ, RIO DE JANEIRO - BRAZIL)

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ABSTRACT

Methane gas packs and its exudation to water column and atmosphere were described in the marine sediments from Saco do Mamanguá Ría (Rio de Janeiro, Brazil). However, the origin of methane gas in the sediments is not clear. Geochemical analysis, methyl coenzyme M reductase (*mcrA*) gene quantification and 16S rRNA gene sequencing were performed to investigate the microbial community structure and its possible correlation with methane gas in Saco do Mamanguá sediment. Furthermore, OTUs related to Bathyarchaeota phylum were selected to comparison with a Bathyarchaeota database previously constructed through metagenome-assembled genomes. By combining molecular methods with stable isotope and geochemical analysis, we found for the first time in Saco do Mamanguá sediments a biogenic origin for methane, and a strong positive correlation of the gas concentration with Bathyarchaeota abundance. We observed a low abundance of Euryarchaeota occurring only in the superficial strata, and no significant statistical correlations were observed between this phylum and methane concentration, which suggests that Euryarchaeota is not leading the current biogenic methane production in these sediments. Otherwise, several bathyarchaeotal OTUs were strongly correlated with methane presence. This result emphasizes the association between methane and this phylum recently described, and indicates a role of Bathyarchaeota in carbon cycle within shallow marine methane-rich sediments. The comparison between our Bathy OTUs and a metagenomic-assembled genomes database revealed genetic similarity with four Bathyarchaeota subgroups potentially related with acetogenesis and methanogenesis. These new findings drive further investigations of Bathyarchaeota in Saco do Mamanguá sediments, with regard to its role in anaerobically degradation of lignin and influence in the biogenic methane production. This work brings a first register of Bathyarchaeota occurrence on the Brazilian coast and shows its dominance compared to other archaeal phyla. Although we have no evidence of who is leading the methanogenesis in Saco do Mamanguá sediments, our geochemical and molecular analysis strengthen the potential relation between Bathyarchaeota and methane in marine ecosystems, and encouraged efforts for further investigation of Bathyarchaeota function in marine carbon cycling.

Keywords: Saco do Mamanguá, marine sediments, Methane, Microbial Communities, Bathyarchaeota

Development Agency: Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP)