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Distribution of active microbial community in CO₂-rich marine sediments at Yonaguni Knoll IV hydrothermal system

Katsunori Yanagawa^{1*}, Michinari Sunamura¹, Yuki Morono², Dirk de Beer³, Matthias Haeckel⁴, Antje Boetius³, Tetsuro Urabe¹, Fumio Inagaki²

¹Earth and Planetary Sci., Univ. of Tokyo, ²JAMSTEC, KCC, ³Max Planck Institute, ⁴IFM-GEOMAR

Large amounts of CO₂ have been observed in the sediment around the Yonaguni Knoll IV hydrothermal field. The high levels of CO₂, provided by phase separation of the hydrothermal fluid, consequently lowers pH in the porewater of sediment. In order to elucidate the effect of high CO₂ and low pH on benthic microbes, we explored the population, diversity, and metabolic function of benthic microbes in CO₂-rich sediment collected at the Yonaguni Knoll IV hydrothermal field during the SO196 cruise in 2008. The active microbial community was investigated by the prokaryotic 16S rRNA-based molecular approaches, microscopic observations, and sulfate reduction rate measurement. Clone library analysis of reverse transcribed PCR products of 16S rRNA showed that the active microbial community became less diverse with depth. In the deep part of sediments where total cell numbers were significantly low, Eel-2 group of sulfate reducer predominated in the bacterial community. Whereas anaerobic methanotrophs forming cell aggregate with sulfate reducing bacteria, inhabited in relatively shallow part of the sediment. Besides, activity of methane-fueled sulfate reduction was sustained even below pH 4.5, which suggested the potential for anaerobic methane oxidation under acidic condition. These results indicated that anaerobic methanotrophs and sulfate reducing bacteria in these acidic environments were metabolically active and could be acidophilic.

Keywords: extreme environment, acidic, pH, anaerobic oxidation of methane, sulfate reduction, CO₂