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# Microbial community and activity beneath the hydrothermal vent at the Iheya North field of the Mid-Okinawa Trough

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Deep-sea hydrothermal fluid harbors peculiar microbial community apparently different from that in the ambient seawater. These distinctive microbes are regarded as messengers transported along hydrothermal vein from subvent biosphere. We have explored scientific drilling at the hydrothermal vent on the Iheya North field of the Mid-Okinawa Trough in Sept. 2010 (IODP Expedition 331) and collected core sample of subseafloor biosphere beneath the hydrothermal field.

IODP Site C0014 was located 450 m east off the main hydrothermal vent. Temperature exceeded the limit of life at the depth of approximately 40 m below the seafloor. Both microscopic and molecular-based analysis successfully detected microbial populations in the shallower zone at 20 mbsf. Microbial community definitely shifted according to physicochemical conditions of their habitat. Additionally, microbial activities of methanogenesis, anaerobic methane oxidation, and acetogenesis were consistent with the geochemical interpretations. These results represented the direct evidence of active subvent biosphere on the edge of uninhabitable zone beneath the hydrothermal vent.

Site C0017 located 1.6 km east off the hydrothermal vent is a potential seawater recharge zone of the hydrothermal system, where seawater penetrates into the oceanic crust. The lithostratigraphy consists of characteristic coarse angular pumiceous gravel, lying above and below hemipelagic mud, suggesting that this layer is probable main pathway of entrained seawater. As is the case with deep sedimentary environment, uncultivated archaeal groups were dominantly detected in the hemipelagic sediment above and below pumice layer. In contrast, ammonia oxidizing archaea of order Nitrosopumilales were outstandingly dominant at pumice layer of around 20 mbsf, possible because of oxidative seawater transport. Though hydrothermal components were not observed from the entire core of Site C0017, deeper layer at around 150 mbsf showed high temperature up to 90C. There, microbial community structure was similar to that from limit of habitable zone of Site C0014. Our data suggests that high temperature gradient due to hydrothermal activity might be one of the control factors of gradual change of microbial community structure in the subvent biosphere.

Keywords: hydrothermal vent, subvent biosphere, methanogenesis, anaerobic oxidation of methane