Subseafloor phase separation and fluid migration supports *Calyptogena* colony in the marginal region of a hydrothermal field

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In the Iheya North Knoll hydrothermal field in the mid-Okinawa Trough (27°47.5'N, 126°53.8'E, depth=1000m), high temperature clear fluid (T=311°C) is vigorously venting from a giant mound structure (named as NBC). Benthic colonies are found not only around the mound, but also in the marginal part of the hydrothermal field; for example a *Calyptogena* colony at 200m east and a tube-worm colony at 250m southeast from the NBC mound.

During Leg 3 of KY05-14 cruise (R/V *Kaiyo* of JAMSTEC) in January 2005, we conducted pinpoint piston coring using a newly developed ROV "NSS (Navigable Sampling System)" that installs a monitor camera and thrusters. Two cores were successfully collected with length of about one meter from the benthic colonies.

Pore fluid in the surface pumiceous sediment collected from the *Calyptogena* colony showed unusual chemistry characterized as low chloride, low magnesium, and high methane concentrations. Lower Na/Cl ratio than seawater and ^{13}C-depleted methane isotopic composition were close to those of the high temperature fluid venting from the NBC mound. These results strongly suggest contribution of a vapor-rich hydrothermal component into the pore fluid, which migrates within the sediment layer from the central mound 200 meters away.

Moreover, notable decrease of sulphate concentration accompanied by increase of alkalinity was found even in the surface pore fluid less than one meter depth below the seafloor. Together with isotopic evidence, the pore fluid chemistry indicates microbial sulfate reduction utilizing the hydrothermal methane. The *Calyptogena* colony would be supported by the product hydrogen sulfide. This idea is supported by a result of microbial population analysis based on taxonomic grouping of gene clone sequencing, which detected sulfate reducing bacteria and methane oxidizing archaea in the sediment sample.

Contrast compositions of minerals, kerogens and lipid-biomarkers in 1.9 Ga shallow- and deep-water sedimentary rocks of the Gunflint Formation, Canada

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In order to constrain the microbial ecosystem of Paleoproterozoic oceanic environments, geochemical analyses were performed on the ca. 1.9 Ga Gunflint Formation, Canada. The examined samples are divided in shallow- and deep-water sequences based on their lithologies and field observations. Hematitic oolites were the representative lithology for the shallow-water sequence and the deep-water sequences contain sideritic banded iron formation. Such contrast in Fe-bearing minerals in chemical sediments suggests the stratified oxic-anoxic oceans during deposition of the Gunflint Formation.

The high productivity of microbes at around the shallow- and deep-water sequences is suggested by the local occurrence of phosphorites. As-rich framboidal-like pyrite was found with euhedral pyrite around such phosphorites, suggesting that sulfate-reducers were active both in anoxic parts of ocean waters and also in sediments.

Kerogens were extracted from 50 samples. Their stable carbon isotope compositions were ranging from -33.6 ‰ to -31.4 ‰ (PDB). 2-□ methyl hopane were identified by GC-MS analyses of lipid-biomarker extracted from black shale samples. These results suggest that cyanobacteria were the major primary producers to support the ecosystem both in oxic and anoxic parts of Gunflint oceans. H/C ratios of kerogens were identical in all samples, although shallow-water kerogens were more enriched in N, implying the different nitrogen-fixation pathway between the shallow- and deep-water ecosystem.