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A chimney-type growth chamber for microbial studies in a sub-surface hydrothermal vent

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Sub-vent environment is characterized by its unique conditions such as high temperature, low pH, oxygen concentration and their environmental gradient expecting to find physiologically and phylogeneticaly unique microbes. But still now, it is quite difficult to directly access this subsurface environment and get such samples without collapsing its environmental conditions. Thus, base on an in situ incubation technique, we developed a chimney-type in situ entrapment/incubator, which can create/maintain physico-chemical gradient on a hydrothermal vent and get microbial samples.

Chimney type chamber consists of a teflon column (400 mm at length, 50 mm at diameter) and its basement made of SUS 305. Inside of the column, aseptical porous grass grains were filled as a microbial adhesion carrier. This chamber in the carrying case was transferred by a ROV/submersible to the venting sites. Just the side of venting site, this case was opened and the chamber was taken out by manipulator and deployed for 2-3 days on a borehole site and natural vent sites venting more than 60 degC hot fluids. At the retrieval, this chamber was carried in the same way using the carrying case. On board, the column was aseptically removed from its basement in a clean bench. The column was divided into 5-10 layers and taken out the grass grains in each layer. Some of the acquired microbial samples in the grains were immediately preserved at -80 degC for phylogenetic analysis, while a portion was used as a microscopic observation and a culture experiment on board.

Diversity of archaeal community structures in chimney type chamber samples deployed at site APSK04 were evaluated by rDNA clone libraries. At bottom part of column, near the hot fluid, the determined rDNA sequences were dominantly occupied by members which were relative to thermophiles. On the other hands, at top part of the column, near sea water, the determined rDNA sequences were dominantly occupied by members of Marine Group within Crenarchaeota, which were relatives found in a sea water or a cold seep sediment. This fact implied that the thermal gradient was created and maintained through the bottom to top of this column. Now, more detail studies including quantitative analysis were undergoing. This equipment is expected to useful for sub-vent microbial study as follows, 1 analyses of the microbial community under physicochemical gradient, 2: elucidating of relationships between microbs and materials.