Microorganisms and nutrients in hot water of Suiyo seamount

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The Suiyo seamount is an about 1,380-m deep submarine hydrothermal vent system located in north-northwest 210-km from the Ogasawara Islands, from which the hot water over 310 degrees is spouting out. In this study, in order to examine the interaction between geology and organisms in submarine hydrothermal system, we drilled Suiyo seamount and drove casing pipes made of iron, and examined for microorganism density in the excavation rocks. Four months later, hot waters from the casing pipes were taken and examined for microorganism density and concentrations of P, N, and the suspension body carbon.

For microorganism density measurement, rocks were treated as follows on a vessel. Rock inside in the 2 cm angle was broached in an anaerobic chamber and smashed by vice and hammer, and 2 ml of 10% formalin were added to fix the microorganisms. After bringing to laboratory, they were further grained with a stainless steel cup and a metal bar, and suspended in 10 ml of 0.1 M phosphate buffer (pH 7.2) and sonicated for 2.5 minutes. After standing for 30 min, 0.5-1.4 ml of the sample was filtered through a Nuclepore membrane (pore size of 0.2 micro-m). The sample on the filter was treated with DAPI (10 ng/ml) and number of microorganisms was counted with a fluorescent microscope. The microorganism density is expressed as cell number/g dry weight. The dry weight was measured after drying core at 60 degrees for 24 h. The water sample was subjected to the measurement of microorganism density as above. Another part of water sample was passed through a glass filter (GF/F) and then through a Nuclepore membrane, and the filtrate was subjected to measurement of all P and all N by the colorimetric methods. The suspension body carbon collected on the glass filter was also determined.

The microorganism density in the rocks was around 10^3-10^5/g dry weight in cores of temperature below 100 degrees, while no microorganisms were detected in deep parts of APSK05 cores whose temperature was 304 degrees. Microorganism density of water samples was in the range of 10^3-10^5/ml, and no relationship was observed between microorganism density and water temperature. Nutrient concentrations were low and it does not seem to support microbial growth, suggesting that it would depend on geology.

From APSK01 casing pipe, low-temperature hot water (maximum temperature 28 degrees) was collected using water sampler which sucked water at low speed. When the nutrient concentrations of the water were compared with that of sea water, we found very little difference. Probably, the casing pipe made of the iron is permeable to sea water, and that the low temperature hot water be a mixture of high temperature hot water and sea water.

We tried to culture microorganisms under the conditions to grow autotrophs from rocks and hot water using solid phase culture system with sea sand. However, it has been unsuccessful when we used the following conditions: gas phase, N2:H2:CO2=80:10:10; pH, 7.5, 6.5 or 5.5; electron donor, 0.04 or 0.12% Na2S; electron acceptor, 20 mM HCO3- or 20 mM NO3-; temperature, 30 degrees. It is considered that the temperature of 30 degrees was too low for these microorganisms, or the electron donor of Na2S was mischoosing. We are now correcting the cultural conditions.