

Dissolved organic matter from deep-sea floor hydrothermal system in South Mariana

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Introduction

In the South Mariana backarc spreading center, a few active hydrothermal fields have been located. Primitive bacteria and archaea have been found in such habitats. In this investigation, we tried to examine dissolved organic matter (DOM) in the hot fluids from a drilled core.

Sample collection

One sample was collected during the ROPOS/TN167A cruise in March 2004 designed for fluid sampling utilized the hole drilled during Hakurei-Maru #2 cruise in January 2004. The hole is located in Fryer site and named APM01. DOM was collected from the hot fluid from this hole. For this purpose, we have developed a standalone filtration system in order to collect and enrich DOM of quite low concentration. This system has an extraction disk (Empore High Performance Extraction Disk C18 90mm, with a prefilter Whatman GMF). This system is also equipped with a thermometer, and can record the temperature of hot fluid during sample collection. Hot fluid was passed through the extraction disk for 30h. The temperature was almost constant at 18-22 degC.

Experimental

Adsorbed organics were eluted using soxhlet extractor with methanol for 12h twice, followed by toluene once. The crude extracts were subjected to NMR (400MHz) and GCMS analyses before and after TMS derivation. After the method of Harvey (1994), a portion of the sample was saponified, and partitioned between n-hexane:diethylether (9:1) and methanol/water. The organic layer (the neutral fraction) was collected and analyzed by GCMS after TMS derivation. Remaining aqueous layer was acidified and partitioned in the same manner. The organic layer (the polar fraction) was treated with BF₃-methanol, and also analyzed by GCMS.

Results and discussion

High resolution NMR spectra of crude extracts from low-temperature hot fluids (APM01 and AP04, Natural vent at Suiyo Seamount, Temp. 8-48 degC) show broad signal near 1 ppm suggesting aliphatic hydrocarbons, and signals at 3-4 ppm may suggest sugars or amino acids, although the signals from the eluates from the extraction disk itself were also observed at 3-4 ppm. The chromatogram of APM01 crude extracts show that the hot fluid contains quite complex organic mixture. However, no biomarker can be found, and the most compounds cannot be identified through mass spectra except mercaptoacetic acid. But, after saponification, the polar fraction shows several fatty acid methyl esters (C14:0, C18:1, C18:0) of extremely low concentrations, suggesting a bacterial biosphere beneath the sea-floor.