Organic compounds in sub-vent and chimney at southern Mariana deep-sea hydrothemal systems

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Deep-sea hydrothermal systems are natural laboratories for the study of organic geochemistry and microbial habitats on extreme environments. A high-temperature deep-sea hydrothermal system related to Suiyo seamount and southern Mariana were drilled using a tethered, submarine rock-drill system as a part of the Archaean Park Project. The benthic multi-coring system (BMS) employed allowed for direct sampling of microorganisms, rocks and fluids beneath hydrothermal vents. Based on the vertical distribution of organic compounds derived from this vigorous sub-vent environment, a description of deep-sea subterranean chemistry and biology was determined detailing optimal microbial activities. Deep-sea hydrothermal sub-vent core and chimney samples were analyzed for total organic carbon (TOC), total organic nitrogen (TON), hydrolyzed amino acids including their D/L ratios, and enzymatic activities such as alkaline and acid phosphatase. Amino acids distribution and their D/L ratio indicated that sub-vent organic matter was occupied by biogenic influence rather than abiotic chemical synthesis. Useful biomarkers of acid phosphatase (ACP) and alkaline phosphatase (ALP) enzymatic activities were positively correlated each other. Biochemical indicators of ACP and ALP were consistent with the origin of total hydrolyzed amino acids (THAA) and the chiral ratio of D- and L-amino acid forms. The significant enzymatic activities demonstrated in this study provides crucial evidence that sub-vent regions represent extreme-environment biosphere, extending the known subterranean habitable spaces of, for example, extremophilic microbes.

This research was performed by Archaean Park Project: International research project on interaction between sub-vent biosphere and geo-environment (2000-2004 Fiscal Year) funded by Special Coordination Fund of the MEXT (Ministry of Education, Culture, Sports, Science and Technology), Japan.

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