

Phosphatase activity in deep-sea hydrothermal sub-vent: Implications for subterranean biosphere

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Introduction

International research project on interaction between sub-vent biosphere and geo-environment at Suiyo seamount, Izu-bonin arc, Pacific ocean have been being investigated. Since it is possible to form bioorganics abiotically, submarine hydrothermal vents have been thought as a plausible site of origins of life on Earth. Phosphate is crucial for life on Earth, hence phosphatase activities is good evidence for microbial markers. Here we report vertical distribution phosphatase activities in such extreme environments and extend of terrestrial biosphere was discussed.

Experimental

Deep-sea hydrothermal sub-vent boring core samples were collected on BMS (boring machine system) Cruise for Suiyo seamount, Pacific ocean. Volcanic sediments were obtained below subjacent of geothermal fluid smoker from 4-308 C. Phosphatase activities were evaluated with a substrate of p-nitrophenyl phosphoric acid as below. Pulverized 0.5 g samples were added with toluene 0.1 ml, modified universal buffer (pH 8.0 or pH 6.5) 2 ml, 25 mM p-nitrophenylphosphoric acid 0.5 ml at 37 C for a hour, and then CaCl₂-NaOH was added for reaction termination. After filtration, absorbance of 410 nm wavelength was observed. Product of p-nitrophenol was calculated for phosphatase activity value.

Results and Discussion

The vertical distribution of acid phosphatase activity has the close tendency with that of total amino acid amount. Background value of phosphatase activity derived from silica or clay minerals showed ca. 0.5 nmol/min/g-rock. In part of APSK core samples, the maximum acid phosphatase activity in the core showed over the back ground level. That might be consistent with phospholipid results (Namba, private communication). It is suggested that terrestrial habitable zone is widespread below submarine hydrothermal vent areas.

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