Vertical distribution of amino acids and phosphatase activities in submarine hydrothermal systems at Suiyo seamount.

Yoshinori Takano[1], tsukasa horiuchi[1], Yae Edazawa[1], Kensei Kobayashi[1], Toshiro Yamanaka[2], Katsumi Marumo[3], Archaean Park Project Team Urabe Tetsuro

[1] Dept. Chem. Biotech., Yokohama Natl. Univ., [2] SCS, Kyushu Univ., [3] AIST, GSJ

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. Among these, amino acids associated with protein are important because it is chiral and the D/L ratio is beneficial as abio- or bio- markers. Phosphate is also crucial for life on Earth, hence phoshatase activities is good evidence for microbial markers. Here we report vertical distribution of amino acids and 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 C-308 C. Analytical procedure of amino acids was preliminary reported last year here (Cm-P004). Phospatase activities were evaluated with a substrate of p-nitrophenyl phosphoric acid as below. Pulverized 0.5 g samples were added with toluene 0.1ml, modified universal buffer (pH 8.0 or pH6.5) 2ml, 25mM p-nitrophenylphosphoric acid 0.5ml at 37 C for a hour, and then CaCl2-NaOH was added for reaction termination. After filteration, absorbance of 410nm wavelength was observed. Product of p-nitrophenol was calculated for phosphatase activity value.

Results and Discussion

Total hydrolyzed amino acids in APSK05 ranged from 30 to 100 nmol/g-rock. The vertical concentration showed positive correlation with total organic carbon (Yamanaka, private communication). The APSK05 site was high temperature and high pressure, although predominance of specific non-proteinous amino acids such as omega-amino acids were not observed (Nazrul et al., 2001). The D/L ratio of amino acids were Asp=0.26, Glu=0.17, Ala=0.09 in APSK05-1-02. Consequently large enantiomeric excesses of L-form amino acids implied that subterranean microorganism activities not abiotic origins. Specific decarboxylation of aspartic acid or glutamic acid were not observed hence sedimentary alteration of amino acids was only restricted. Vertical distribution of acid phosphatase activity has the close tendency with that of total amino acid amount. In APSK07 samples, the maximum acid phosphatase activity in the core 2-01 gave 2.4 nmol/min/g-rock. That might be consistent with phospholipid results (Namba, private communication).

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