

Amino acids in hydrothermal water samples from deep-sea hydrothermal vents

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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. Amino acids in 300 C hydrothermal water samples derived from deep-sea hydrothermal vents at Suiyo Seamount, Izu-bonin arc, Pacific ocean were investigated. Hot spring water samples such as deep-sea hydrothermal systems contains amino acids and various organics. Protein associated with life are only L-form of amino acid, hence D/L ratio will be risen by geochemical racemization progress. Actually, poor biological activity region shows higher D/L ratio. It has been known, recently, that some very specific environment such as submarine hydrothermal vent make biological active colonies. Here, D/L ratio of amino acid enantiomers was used as a biomarker in order to verify microorganism activity in subterranean biosphere.

Experimental

Hydrothermal water samples derived from natural vents and artificial drilled vents were collected in deep-sea hydrothermal vent at Suiyo seamount, Izu-bonin arc, Pacific ocean. Those samples were separated filtered portions and non-filtered portions. Then, samples were acid-hydrolyzed with 6 M HCl for 24 hr and desalted with cation exchange resin. After fractionation, o-phthalaldehyde (OPA) and N-acetyl-L-cystein derivatization and solid phase extraction was carried before HPLC analysis. Derivatized sample were analysed by RP-HPLC (Pump: TOSOH CCPM II, column: YMC-Pack pro C18, 4.6 mm i.d x 25 mm), where gradient elution with 40mM acetic acid buffer (pH 6.5) and 100% MeOH was applied. Representative proteinous amino acid such as aspartic acid, glutamic acid and alanine were quantificated for D/L ratio determination.

Result and discussion

Proteinous amino acids such as Gly, Ala, Ser were predominant than non-proteinous amino acid such as alpha-aminobutylic acid. Experimental procedure and gradient pattern of RP-HPLC made it possible that D- and L- enantiomers were well-separated each other. Small value of D/L ratio for Asp, Glu, Ala indicated that amino acids in hydrothermal sample came from biological origins of subterranean biosphere. Every proteinous amino acid of L-form was more predominant than D-form. In addition, further work for the study of relationship between racemization and D/L ratio with abiogenesis has been verified. Determination and stereo isomer ratio of amino acid (D/L ratio) were indicative for biological origins of organics from sub-vent biosphere.

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