# Stability and dissolution rates of amino acids during hydrothermal reaction between sediments and artificial seawater

# Miho Ito[1], Lallan P. Gupta[2], Harue Masuda[3], hodaka kawahata[4]

[1] Geoscience Sci.,Osaka City Univ, [2] AIST, [3] Dept. Geosci., Osaka City Univ., [4] GSJ

Introduction

Deep sea floor sediments are large reservoirs of amino acids, which are basic organic materials comprising organisms. In order to assess survival conditions of organisms under seafloor hydrothermal systems, it is important to understand stability of amino acids in the sediments at hydrothermal conditions. Here, we show the experimental results of stability and dissolution rates of amino acids in the tuffaceous sediments from Loihi Seamount (in Hawaii) and mud sediments from Lake Biwa (in Japan).

Experimental

5 g of dry powdered sediments and 50 ml artificial seawater were enclosed in a titanium vessel, which was sealed after flushing with Ar gas. The vessel was heated at 100 degree C, 150 degree C and 200 degree C for 5-40 hours. After cooling, the reacted samples were separated into liquid and solid by centrifugation and sedimentation. The separated samples were hydrolyzed with HCl at 110 degree C for 22 hours. 20 species of amino acids in the prepared solution were analyzed by the HPLC (Shimazu LC-9A, Hitachi L-8500).

Results and discussion

Total concentrations of amino acids (TAA) in the starting sediments were 633 pmol/mg in the sample from the Loihi, and 11300 pmol/mg in that from Lake Biwa. After 5 hrs reaction at 100 degree C, TAA decreased to 557 pmol/mg for the Loihi sediment. TAA was 140 pmol/mg for the Loihi sediment after 5 hrs reaction at 200 degree C, and the amino acids were mostly decomposed after 20 hrs reaction. In the solution reacted with Loihi sediment, 1905 pmol/ml of TAA was dissolved after 5 hrs reaction at 100 degree C. The TAA gradually increased during reaction time, and it reached 59130 pmol/ml after 30 hrs. The maximum of TAA in the reaction at 150 degree C was 26650 pmol/ml after 20 hrs. It turned to decrease after that time. The maximum concentration of TAA was recorded to be 27900 pmol/ml after 5 hrs at 200 degree C, then, it gradually decreased with time.

Among 20 amino acids analyzed in this study, Arginine tended to remain in sediments even at 150C. After the reaction at 200 degree C for 5 hrs, Aspartic acid, Arginine, Threonine, Serine, and Isoleucine were completely decomposed. Lysine remained in the sediments even at 200 degree C, while it was decomposed in the liquid. Leucine, Proline, and Phenylalanine were lost from the sediments, however, these amino acids remained in the liquid. Glutamic acid, Glycine, Alanine, and Valine were partially remaining in the both sediments and liquid.

The solubility of amino acids obtained in this experiment discorded with that of pure amino acids. Thus, it is valuable to estimate physical-chemical properties of amino acids using natural materials when considering the behavior of amino acids in the naturally geologic system. Hereafter, the composition in amino acids from the active hydrothermal field will be verified by the more precisely designed laboratory experiments.