

# Stability of amino acids and related compounds in simulated submarine hydrothermal systems.

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Submarine hydrothermal systems (SHSs) have been regarded as favorable sites for chemical evolution toward the origin of life on the Earth. Organic compounds could be formed in primitive Earth atmosphere and/or be delivered by extraterrestrial bodies. These organic compounds were transformed in high temperature and high pressure environments of SHSs. It was claimed, however, that organic compounds, particularly amino acids, are not stable in high temperature environments. We reported that not free amino acids but complex precursors of amino acids could be formed abiotically from either simulated primitive atmospheres or simulated interstellar media. Here we examine the stability of free and combined amino acids in high temperature and high pressure environments simulating SHSs by using a supercritical water flow reactor (SCWFR).

Target molecules are as follows: Free amino acids, protein (human serum albumin = HSA), complex amino acid precursors formed from a mixture of carbon monoxide, nitrogen and water by proton irradiation (hereafter referred to as CNW). Molecular weight of CNW were some thousands.

Aqueous solutions of the target molecules were heated in SCWFR at 473 - 673 K for 1 - 4 min, and then quenched in ice bath. The pressure was maintained at 25 MPa during the reaction. Amino acids in the resulting products were analyzed with an amino acid analyzer after acid hydrolysis. Molecular weights of the products were estimated by gel filtration chromatography.

Recovery ratio of alanine in HSA and CNW were 30 % and 42 %, respectively when they were heated at 573 K for 2 min, while that of free alanine was only 0.02 %. It was shown that combined amino acids were far more stable than free amino acids in high temperature environments. HSA was decomposed into shorter fragments during heating, while, molecular weight of CNW was little changed. These results suggest that complex precursors of amino acids formed prebiotically could survive in primitive SHSs.

In these days, novel biosphere have been found in subsurface of SHSs through the Archaean Park Project. It would be of great interest to find signatures of biological and abiological amino acids in such extreme environments.