

Formation of carboxylic acids from simulated primitive atmospheres

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Gas mixtures of carbon monoxide, nitrogen and water, which simulate primitive planetary atmospheres, were irradiated with high energy protons. The resulting products were hydrolyzed, and then carboxylic acids in them were determined.

In prior to the generation of on the primitive Earth, various organic compounds should had been produced and supplied to the primitive ocean. One of the possible source of these organic compounds are primitive atomosphere. It is estimated that the primitive Earth atomosphere was mixture of carbon dioxide, carbon monooxide, nitrogen and water. We have detected a wide variety of amino acids in the proton irradiation product of such gas mixtures. Here we tried to determine carboxylic acids in the same type of gas mixtures, liquid water are sealed in the Pyrex glass tube. The gas mixture was irradiated with high energy protons (3 MeV, 2mC) from a Van de Graaff accelerator (Tokyo Institute of Technology). After irradiaton, an aliquot of the products was collected, and hydrolyzed at 383K for 6-113h in 50mM NaOH aqueous solution. The hydrolysate was freeze-dried, and carboxylic acids were analyzed by capillary electrophoresis(Otsuka electoron CAPI-3300), Amino acids were analyzed with an amino acid analysis system (Shimadzu LC10A).

Such monocarboxylic acid as formic acid (C1), acetic acid (C2) and propanoic acid (C3) were detected by capillary electrophoresis. The yield of carboxylic acids increased when the period of hydrolysis was increased up to 48h. The yield of acetic acid was 22 micromoles, which was almost of the same level as that of glycine. The larger the carbon number of carboxylic acid is, the smaller the yield is.

This tendency is the same as that amino acids.

We reported that major product of proton irradiation of the gas mixtures are complex organic compounds with large molecular weight, which produce amino acids and nucleic acid base (uracil) after hydrolysis. The present results suggest that the complex organic compounds also yield carboxylic acid after hydrolysis. In order to investigate the structure of the complex organic compounds, we are going to determine carboxylic acids, amino acids and amines in the proton irradiation products from various gas compositions under various hydrolysis conditions.