B001-P024 Time: May 26 17:15-18:45

Interaction experiments between RNA molecules and phosphate minerals

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Transportation of genetic information is one of the most important elements for life, and this role was mainly taken by in the actual life. But, little is known about its formation pathways. Especially, polymerization mechanisms of organic molecules (bases, sugars, nucleosides and nucleotides) into RNA are the most unknown processes.

It is known that some mineral surfaces adsorb organic molecules and provide the reactive sites for bonding. As RNA is made of nucleotides bound by phosphodiester linkages, it is possible to formulate a hypothesis that polymerization into RNA is facilitated at the surface of phosphate. In this study, phosphate-RNA molecules interation experiments has been conducted at high(140degree) or room(25degree) temperature by using adenine as a representative base, adenosine as a nucleoside, Fluorapatite and Hydroxylapatite as a phosphate. UV-visible spectroscopy have been used for analyzing solutions, IR spectroscopy has been used for analyzing solids.

Adenine was stable at both high and room temperature, and interaction with phosphate did not occur. Adenosine was also stable at room temperature, but at high temperature(140degree), UV-visible spectra of adenosine solutions shows some changes.

First, the absorbance at 260nm decreased with time. Moreover, in the case of solutions heated with phosphate, the rate of decrease was increased. The decrease rate was maximum in the presence of HAP.

Based on the quasi-linear decrease of 260nm absorbance of adenosine with time, the adenosine transformation reaction is supposed to be a zeroth order reaction. Reaction rate constants k0 can be determined by the gradients of the regression lines: k0=1.3x10-7 s-1 for adenosine only(140degree) and k0=3.0x10-7 s-1 for adenosine with HAP (140degree). These results indicate that HAP makes the adenosine transformation faster for about 2.3times.

On the other hand, the another characteristic of heated adenosine was that the adenosine at 269nm became relatively stronger. This characteristic was not remarkable when HAP exists.

Based on these results, the following adenosine-HAP interation model is suggested. First, heated adenosine was decomposed into compounds X and Y(X has absorption at 269nm). Then, X was adsorbed on the surface of HAP.This adsorption of X on HAP accelerate the adenosine decomposition.

In this study, adenosine-HAP interaction existed at 140degree. Further studies are needed to investigate the role of this interation in the chemical evolution for genetic molecules.