

五炭糖の分解速度に対するケイ酸の影響 Effects of silicate on the decomposition rates of pentoses

新田 祥子^{1*}, 古川 善博¹, 掛川 武¹
Sakiko Nitta^{1*}, Yoshihiro Furukawa¹, Takeshi Kakegawa¹

¹ 東北大学大学院理学研究科地学専攻

¹ Graduate School of Science, Tohoku University

RNA is considered as a very important molecule for the origin of life because RNA carries genetic information and several RNA catalyze biological reactions. Ribose is an essential constituent of RNA. Ribose as well as the other pentoses can be produced abiotically through formose reaction. However, ribose is the most unstable pentose among of the pentoses produced by the formose reaction. Therefore, stabilization of ribose has been very important issue. For the solution of this problem, a previous study proposed that pentoses including ribose are stabilized forming complexes with silicate. Because of technical difficulties, it has not been clear which pentoses are stabilized by silicate. This study adopted a new application of liquid chromatography-mass spectrometry for the pentose analysis. The method made it possible to determine the concentration of each uncomplexed pentose. Incubation experiments of aldopentoses, ribose, lyxose, xylose, and arabinose, with three concentration of silicate have conducted in this study. In silicate-free solution, ribose had the highest rate of decrease. The rate of decrease for all aldopentoses became smaller with the concentration of silicate. In particular, the rate of decrease for ribose was significantly decreased. This result shows that silicate stabilize aldopentoses, especially ribose. Silicate is common in all over the world as silicate minerals and might have been common on the early Earth. Therefore, the selective stabilization of ribose by silicate might have provided a mechanism for the selection of ribose as the sugar in RNA on the early Earth.

キーワード: RNA, ケイ酸塩, リボース, 五炭糖, 液体クロマトグラフ/質量分析計
Keywords: RNA, silicate, ribose, pentose, liquid chromatography-mass spectrometry