Experimental study on atmospheric synthesis of organic compounds: A role of ferruginous ocean

KAWADE, W[1*], UENO, Y[1,2], KITADAI, N[2], HOUGO, Y[2]

[1] Department of Earth and Planetary Sciences, Tokyo Institute of Technology, of Technology, Meguro, Tokyo, 152-8511, Japan ([*]correspondence: kawade.w.aa@m.titech.ac.jp)

2 Earth-Life Science Institute, Tokyo Insitute of Technology

Photochemistry is important for the origin of life and the early earth's environment. Previous photochemical experiments suggest that the reaction initiated by UV in CO-rich atmosphere can produce simple organic compounds mainly formaldehyde and methanol [1,2]. The amount and speciation of organic molecules are known to depend on redox state of atmosphere. Under the presence of liquid H_2O, production rate of organic molecules are an order of magnitude faster than the H_2O-unsatulated condition, suggesting photolysis of water is critical to initiate the abiotic UV synthesis. Also, the reducing ocean containing ferrous iron may possibly control the redox state of the ocean-atmosphere system, though the role of ferruginous ocean for abiotic UV synthesis is poorly understood. We have conducted a new photochemical experiments to simulate the reducing atmosphere and Fe(II)-bearing ocean. The results of our experiments suggest that formate, acetate, propionate, and normal alkanes are synthesized under CO-atomosphere in contrast to previous expeirment. Under the presence of Fe(II)-bearing water, the production rate of formate is about three times faster than the simple CO-H_2O system without ferrous iron. Furthermore, formate is formed even when the gas phase is pure CO_2 when liquid-phase contains Fe(II). These results suggest that the production rate and speciation of organic matter depends on the availability of H_2O as well as total redox state of the whole atmosphere and ocean systems. Based on the results, we have modeled the reaction network and calculate supply rate of each organic compounds into early ocean.

[1] Bar-Nun & Chang (1983) *JGR*, **88**, 666. [2] Pinto *et al*. (1980) *Science* **210**, 183