二価鉄を含む古海洋表層において生成する有機物の光化学実験

A role of ferruginous ocean in photochemical synthesis of organic compounds

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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 (Bar-Nun and Chang, 1983). The amount and speciation of organic molecules are known to depend on the redox state of the atmosphere. The reducing ocean containing ferrous iron may also 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 photochemical experiments simulating the reducing atmosphere and Fe(II)-bearing ocean. The results of our experiment suggest that formate, acetate, propionate, and normal alkanes are synthesized under CO-atmosphere. When irradiating UV 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 system. Based on the results, we have modeled the reaction pathway and estimate the flux of each organic compounds supplied to early ocean.

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