Water-Rock-Organic interaction system to synthesis peptides under the Enceladus hydrothermal condition

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Chemical evolution is an abiotic reaction process in which complex organic molecules arise from a combination of simple inorganic and organic chemical compounds. In order to assess the ongoing chemical evolution at the subsurface ocean of Saturn’s icy satellite Enceladus, we focus to explore the water-rock reaction and the possibility of peptide formation under Enceladus hydrothermal environment. It has been suggested that the core of Enceladus has never experienced a high temperature environment from the time of satellite formation to the present. The major component of the core is assumed to be carbonaceous chondrites and thus, simple organic substances including amino acids are likely to be present under Enceladus alkaline seawater. In this study, we conducted a laboratory-based simulation experiment to describe the chemical alteration of six prebiotically abundant amino acids over 147 days under high pressure and thermal cycling system (30 ℃ to 100 ℃) to simulate the water-rock interface of Enceladus ocean. We found out that autocatalytic reaction starting from Gly-Gly promoted subsequent dipeptide formation, suggesting that organic matter diversity in Enceladus seawater was self-sufficient. We suggest that various dipeptide and other organic matter diversity plays an important contribution to the ongoing chemical evolution in the Enceladus.

Keywords: Enceladus, Water-Rock-Organic interaction, Hydrothermal system, Peptide, Chemical evolution

