

Short peptides formed under Enceladus hydrothermal condition

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Enceladus is one the sixth largest moon of the moons of Saturn, and it has been known to harbor interior ocean beneath the icy crust. , which hold important factors necessary for life such as organic compounds, liquid water, and high temperature condition. The mass spectrometry data and the presence of nanometer sized silica particles obtained by *Cassini* spacecraft indicates the presence of salty, and most likely alkaline ocean containing various simple organic compounds. While geochemical and other radiation related processes for the *in situ* production of organics remain elusive, thermally unaltered carbonaceous chondrites, consisting the main body of Enceladus are known to be enriched with organic matters such as simple amino acids. potentially including the Therefore we Enceladus alkaline seawater, we hypothesized that an ongoing chemical evolution and polymerization of amino acids coupled with water-rock interaction under simulated Enceladus hydrothermal condition. Serpentinization coupled may contribute to dehydration may lead to condensation of surface localized amino acids leading to peptide formation. Short peptide is significant important for primitive life in terms of initial chemical evolution In order to test this hypothesis, we have developed the Enceladus hydrothermal reactor based on the chemical constraints obtained through previous experimental and theoretical studies. We have added six different abiotically available L-amino acids (Gly, Ala, Asp, Glu, Ser, Val) that are and introduced a thermal fluctuation system simulating the periodic tidal heating of the interior chondritic core. The pH monitoring and H₂ and CO₂ Gas Chromatography (GC) data clearly indicated the occurrence of serpentinization / carbonation reaction. Organic compounds data estimated by Orbitrap Fusion suggest the interaction between amino acids, aqueous alteration reaction and thermal cycling processes for the role of abiotic peptide formation under alkaline hydrothermal condition. Here, we discuss the interaction between aqueous alteration reactions and thermal cycling processes for the role of abiotic peptide formation under the Enceladus hydrothermal condition.

Keywords: Enceladus, Amino acid, Peptide synthesis, Hydrothermal reactor