

Prebiotic formations of nucleotide and peptide around Hadean juvenile crusts

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*掛川 武¹

*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

Geological information of the Hadean Earth is the key to constrain how and where prebiotic nucleotide and peptide formed. Previous experiments for prebiotic nucleotide formation required high concentration of phosphate with water-free conditions. In addition, UV radiation or borate accumulation was also necessary to promote the chemical reactions. Such conditions could have been occurred in shallow evaporate environments on the Hadean Earth. Most previous experiments to form prebiotic peptides were simulating tidal flat, submarine hydrothermal and volcanic fume environments. Simple peptides were formed by those experiments with addition of sufficient heat energy. However, abundant DKPs, which often prohibit elongation of amino acids, were also produced simultaneously. On the other hand, production of DKPs was limited when experiments were performed by high pressure and temperature conditions. In addition, high P and T experiments could produce methionine peptide and alanine beta-sheet, which are important peptides to form structured protein. These results imply that high P and T conditions, corresponded to sub-seafloor environment, were suitable for formation of key peptides. Those results further indicate that prebiotic nucleotides and peptides have been formed separately at different geological environments. Hadean juvenile crust (i.e., proto-arc) provided ideal environments for prebiotic nucleotide and peptide formations.

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