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Experimental and geological link for prebiotic peptide and ribose formation
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掛川 武 [1*]
Takeshi Kakegawa[1*]

[1] 東北大学
[1]Tohoku University

Controversy exists as to which geological environments were suitable for prebiotic organic formation. In this presentation, potential geological environments to form peptide and ribose will be discussed. Heat energy is necessary to promote polymerization of amino acids and then to form peptides. However, once-formed peptides easy break if heat energy suppresses and amounts of water exceed the peptide-equilibrated amounts. During diagenesis of deep marine sediments, where dehydration proceeds under high P and T conditions, may provide ideal environments for the peptide formation.

High pressure (150MPa) and temperature (up to 180C) experiments were performed in order to examine if daigenetic conditions are ideal for peptide formations. A mixture of glycine and alanine or a mixture of methionine and glycine was used as a starting material. Amounts of ammonia in reaction system increased with time, suggesting broke down of amino acids. On the other hand, amounts of glycylalanine, glycylglycylalanine glycylmethionine and methiolmethionine were high and exceed the amounts of glycine-5mers and alanine-4mers. The resuslts of the present study suggest that peptides composed of different amino acids has easily formed with high yields under high P and T conditions accompanied with high ammonia concentrations. Presence of ammonium-mica in Isua Supracrustal Belt in Greenland may suggest ammonia-rich diagenesis in ancient marine sediments, supporting the present experimental results.

For prebiotic ribose formation, stepwise reactions between borates and formaldehyde are suggested. Such interaction happens only under high borate concentrations. Borate-rich environments are often considered as unrealistic on the early Earth. However, tourmaline-rich garnets in sediment-protolith were found in Isua Supracrustal Belt. This finding suggests that borate-rich conditions were present during diagenesis of ancient marine sediments, and promises ribose formation during diagenesis.

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