

Polymerization of valine under high T and P conditions : its implication to the chemical evolution in the early Earth's crust

Takato Ishiguro[1]; Takeshi Kakegawa[2]

[1] Inst. Mineral. Petrol. and Econ.Geol. Earth Science, Tohoku Univ.; [2] IMPE., Tohoku Univ.

It has been uncertain as to how the single molecules of amino acids polymerized to peptides on the primitive Earth. Most previous researches were focusing polymerization of alanine and glycine even under high temperature and pressure conditions, but it was not certain for other bio-essential amino acids, including valine.

Polymerization experiments of valine were performed in this research considering high pressures and temperatures. Experiments were performed under various pressures of 0.5-100 MPa at 150 degree C for 1-32 days, simulating the deep sedimentary environment of the primitive Earth. In addition to the simple valine system, the interaction between valine and montmorillonite was also examined. Running products were carefully analysed using HPLC.

The results suggest the following three points. (1) With the elapsed time, polymerization of valine promoted especially to di-peptide. (2) The optimum pressure exists for a polymerization reaction of valine. (3) Montmorillonite is a suitable catalyst in the reaction that valine is converted into val-val under high P and T conditions. Note that it was difficult to analyze tri-peptide in the present analytical method, because of non-availability of the standard, but many circumstances suggest the formation of tri-peptide in the experiments.

The above results suggest that chemical evolution could have happened the primitive Earth's crust in where pressure, temperature and clay minerals were available.