

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

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It has been uncertain as to how the single amino acids polymerized to peptides on the primitive Earth. Previous researches indicated that alanine and glycine can be polymerized in high temperature and pressure conditions, but it was not certain for other bio-essential amino acids, including valine.

Therefore, polymerization experiments of valine were performed in this research using the high temperature and pressure autoclave. Experiments were performed under various pressures of 0.5-100 MPa at 150-200 deg C for 1-32 days, simulating the upper crustal environment of the primitive Earth. In addition to the simple valine system, the interaction between valine and montmorillonite was also examined. Total of 14 experiments were performed during the course of this thesis study. Running products were carefully analyzed using LC-MS.

These results lead the following three suggestions. (1)With the elapsed time, polymerization of valine increased slightly to di-peptide. (2)As the temperature rises, polymerization of valine promoted to di-peptide. (3)The optimum pressure exists for a polymerization reaction of valine. (4)Montmorillonite behave as a good catalyst in the reaction that valine is converted into val-val under high P and T conditions. Moreover, the formation of tri-peptide was detected in the experiments.

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