

Polymerization experiment of amino acids under high pressure and temperature conditions simulating the deep crust

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1. INTRODUCTION

The onset of polymerization of amino acids must have been a major step in chemical evolution. Previous investigators have attempted the polymerization of amino acids assuming Earth's surface environments (less than 25MPa). On the other hand, the previous thermodynamic circulation predicted that (1) temperature and pressure increase promotes the polymerization of amino acids and (2) frequent occurrence of cyclic amino acids to disturb peptide formation (Shock, 1993).

Therefore, we hypothesize that the formation of protein proceeded in the deep crust where the enough pressure and temperature are available to promote peptide formation.

In this study, experiments were performed to determine optimum pressure and temperature for peptide formation and breakdown for cyclic amino acids.

2. EXPERIMENTAL

Amino acids used in this experiment were glycine and alanine (Wako Co.). They were sealed in gold capsule respectively. These gold capsules were placed into the test tube type autoclave for 1 to 7 days with conditions of 150 degrees at 50MPa to 200MPa.

After reaction, each capsule was opened carefully. Ion-exchange water was added to solve organic molecules, and analyzed by a high performance liquid chromatography (HPLC).

3. RESULTS AND DISCUSSION

The results of HPLC analysis indicates that (1) the major component in product is cyclic-glycine and cyclic-alanine, (2) the yield of cyclic amino acids had a tendency to increase with pressure and (3) temperature increase had a negative effect for the polymerization of amino acids. According to our previous research, peptides were also synthesized in the similar P/T conditions.

This study is the first report that pressure increase inhibits the cyclization of amino acids. These pressures were corresponding to the lower crustal level, suggesting that the pressure is an important factor to promote polymerization of amino acids.