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Impact Chemical Evolution Prosesses for Simple Amino Acids (Glycine and Alanine) Formed by Oceanic Impact

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The biomolecules on Earth are thought either to have come from the extraterrestrial parts carried with flying meteorites or to have be formed on Earth from the inorganic materials through given energy. From the standpoint to address the importance of impact energy , it is required to simulate experimentally the chemical reactions during impacts, because violent impacts may have occurred 38-40 years ago to create biomolecules initially. Shock reactions between ocean and meteoritic constitutions can induce locally reduction environment to form bioorganic molecules such as amino acid.

We need to know possible processes how the chemical evolution proceeds further by impacts and how complicated biomolecules are formed. In this study we prepared aqueous solutions of the two simplest amino acids (glycine and alanine) labeled by ^{13}C and investigated the reactions. Shock recovery experiments were carried out with a propellant gun. Sample of aqueous solution immersed in olivine powders sealed in a stainless steel container was used as a target. The sample space has air gap behind the mixture of olivine and solution. In some shots we added ammonia solution and so on to model the old ocean composition. The recovered samples were analyzed with LC/MS for water soluble components and XRD and TEM for solids. The analytical results indicate the formations of alanine from glycine, glycine from alanine, and amines from the both and that the residual glycine and alanine in each solution are very small less than 1%. There is no evidence for formation of complicated amino acids even if benzene was added. The starting olivine particles became fine-grained and some grains had reaction rims of hydration. According to the present results, simple amino acids of glycine and alanine can change one another, but they decompose amines and others mostly. So, these results imply not only that the impact-induced process is not so simple to proceed the chemical evolution just to one way, but also that there are complicated and multi-process ways. In meteorite impacts, it also must be taken into account the heterogeneous distribution of impact energy in an impact that may cause a significant effect on the chemical evolution.