

# Possible Formation of Pre-biotic Organic Compounds by the Impact Event to the Early Ocean

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Atmosphere of early Earth is thought to be slightly oxidative: mainly nitrogen and carbon dioxide. But the impact event of ordinary chondrite to the early ocean might have created locally reducing post-impact plume (Nakazawa, 2005, in prep.). Our previous experiments confirmed that ammonia was easily created from N<sub>2</sub> in the post-impact plume. This further leads us to propose new hypothesis that pre-biotic organic molecules were prepared during the impact event. The main purpose of this study is to examine the above hypothesis by simple experiments.

Two different experiments were performed to simulate reaction (a) during the impact event and (b) inside of post-impact plume. Shock experiments were performed to simulate the impact event. Single stage explosive gun was used for this experiment (Sekine, 1997). Shock pressure was estimated to have been reached up to 20 GPa. Specially designed capsules were used to hold liquid water to create water vapor during experiments and to recover soluble products. Starting materials include metallic iron, graphite powder and ammonia water. After the experiment, the capsules are washed carefully and water-soluble materials were extracted. For the analyses, High Performance Liquid Chromatography and GC-MS were used. Separation of each amino acid was done by the cation-exchange column. For the amino acid analyses, solutions of o-phthalaldehyde (R1, R2, R3, HITACHI) were added to water-soluble products after column separation and detected by the fluorescence detector. Preliminary analyses indicate simple organic compounds were identified in the running products.

Mineral-graphite interaction experiments were performed in the hot heated furnace to examine the potential organic reaction within the post-impact plume. Continuous gas flow line, directly connected to furnace, was build: this flow line is composed of a gasses-supplying unit, a reaction unit and a quench-recovering unit. The Gasses-supplying unit is arranged to send ammonia gas and water vapor to the reaction unit by carrier gas (N<sub>2</sub>). In the reaction tube, mixture of metallic iron, nickel and graphite were reacted with gas phases. The recovered liquid in the terminal trap was analyzed by HPLC. Again, preliminary analyses indicate the production of amine and amino acids (?). This study indicates that (1) effects of the impact event on organic production has been underestimated previously, (2) variety of pre-biotic organic molecules could have been produced during the impact event and following the post-impact event, (3) these were most likely accumulated in the early ocean forming the pre-biotic organic soup, and (4) chemical evolution for the origin of life may have proceeded using these organic molecules. This new hypothesis contradicts to extraterrestrial origin of amino acids.