In-situ observations for the formations of Chemical bonds under laser shock compression: Implications for chemical evolution of biomolecules by meteorite impacts

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To clearing up the enigma of occurrence of life is one of the most important research topics on the fields of planetary and biological science. We must explain and understand the chemical evolution of biomolecules related origin of life based on the “appropriate” geological settings. And then, it has been known that simple organic materials such as amino acids can be synthesized from inorganic materials by several energy sources such as shock wave, UV ray, heat, and radial rays (e.g. Furukawa et al., 2009; Huber and Wächtershäuser, 2006; Marshall, 1994). Especially, meteorite impact inducing shock wave has the huge energy, which is thought that it has played an important role to generate simple biomolecules and to promote the chemical evolution.

In this study, we focus on the creating process of C-C bonding by shock-induced reactions. The C-C bonding is one of the most basically components of biomolecules, and the essential ingredient to form the early life such like building a block. We conducted laser shock experiments coupled with a spectroscopy for hydrocarbon in order to observe the formation reaction of C-C bonding under shock condition. Shock velocity of sample were measured simultaneously by using VISAR (velocity interferometer system for any reflector) system [Barker and Hollenbach, 1972]. Shock pressure for hydrocarbon in this study were from 100 to 150 GPa.

The experimental results indicated that the molecular spectrum derived from C-C bonds were observed from shocked hydrocarbon. Our study suggests that meteorite impacts on the planet possessing a hydrocarbon of atmosphere and ocean (e.g. Titan and Uranus) might be able to produce a lot of organic species related origin of life. The detailed results and discussions will be shown as this presentation.

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