[EE] Evening Poster | B (Biogeosciences) | B-AO Astrobiology & the Origin of Life

# [B-AO01]Astrobiology

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Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)

Twenty years have passed since when the field of Astrobiology, which aims to unveil the origins, evolution, and habitability of life by integrating multidisciplinary fields, was established. Origins of Life are currently being re-conceptualized via expansion of prebiotic chemistry to systems chemistry and chemical space. Besides their relationship to life's building blocks, it is expected to demonstrate the significant roles of organic molecules in the history of planetary formation. The linkages among the variations in chemical compositions of deep-sea hydrothermal environments, geological settings, and ecological systems were systematically investigated. Cassini, which accomplished in the long-term explorations of the planets bearing liquid, had "Grand Finale" this year. Discoveries of extrasolar planets have been dramatically increased to date.
Originally, Astrobiology does not need a specific science category. We therefore aim to make this session so that Earth and Planetary scientists from all the categories join for discussing 'where we came from and where we are going' and for making novel integrated researches.
For the next stage of Astrobiology, presentations on the instrument development in space explorations, comparative studies of solar system and exoplanets, etc, will be very much welcome.

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# [BAO01-P03]Effect of Minerals on Amino Acids Formation in Environments Simulating Parent Bodies of Meteorites

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The origin of life on Earth is not yet understood. Extraterrestrial organic compounds are considered as a key for understanding prebiotic organic synthesis in the early Earth. Several pathways have been proposed for the formation of extraterrestrial organic matters. Recently, Cody et al. [1] proposed the hypothesis that IOM and refractory organics in comets could be produced through the condensation of interstellar $H_2CO$ via formose reaction after planetesimal accretion, in the presence of liquid water in the early solar system. Additional hydrothermal experiments showed that ammonia enhanced the yields of organic matter [2] and produced amino acids [3]. The mineral surfaces could have been strongly involved throughout the process of synthesis of organic matter to contribute promoting prebiotic reactions. Pearson et al. [4] found that the meteoritic organic matter is strongly associated with clay minerals suggesting that clay mineral may have had an important catalytic role in chemical evolution in the early solar system.
In our present research, we are studying possible role that minerals such as montmorillonite clay and olivine could have played in the processes for the amino acid productions in water-bearing planetesimals.

First we synthesized organic compounds using a mixture of water, formaldehyde and ammonia ($H_2O$, $H_2CO$, $NH_3$) in a ratio of 100:5:5 and 100:7:1 by simulating primordial materials in comets and asteroids, in order to compare between two ratios. Adding some minerals (10 g/L) to these solutions to study their effects on the formation of amino acids. Aqueous solutions were heated in oven under various temperatures (100 - 150°C). The resulting products were then acid hydrolyzed (6M HCl, 110°C, 24h), desalted, and subjected to amino acid analysis by high performance liquid chromatography (HPLC).

After acid hydrolysis, amino acids including glycine, alanine and beta-alanine were detected, while a little or no amino acids were detected without acid hydrolysis. Our preliminary results showed that the yields of amino acids were enhanced with the presence of minerals. These results suggested that the associated minerals were act as catalysts to produce amino acid precursors during aqueous activities in the planetesimals.

References:

[1] Cody et al. (2011) PNAS 108, 19171-19176.
[2] Kebukawa et al. (2013) ApJ 771, 19.
[3] Kebukawa et al. (2017) Science Advances 3, e1602093.
[4] Pearson et al. (2002) Meteoritics &Planetary Science 37, 1829-1833.