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# Exposure Experiments in the 2nd Japanese Astrobiology Experiment, Tanpopo2

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## Abstract

Japanese astrobiology mission named "Tanpopo" by utilizing the Exposed Facility of Japan Experimental Module (JEM/EF) of the International Space Station (ISS) was proceeded since 2015. The Tanpopo Mission included the capture experiment and the exposure experiment. In the experiments, microorganisms: *Deinococcus aerius* and *Nostoc* sp. HK-01, and organic compounds: glycine, alanine, isovaline, hydantoin, 5-ethyl-5methyl-hydantoin, complex organics (CAW) were exposed for 3 years. In addition, the exposure of quenched carbonaceous composite (QCC) was also performed using the JEM/FF. In those experiments, we obtained some interesting results, but some new questions were also raised through these experiments. Therefore, we planed new astrobiology experiments named "Tanpopo2" using the JEM/EF, ISS.

Three types of panels are employed in Tanpopo-2 mission. The TNP2CP panels are ultra-low density silica-aerogels for capture cosmic dust and space debris in the space. In this mission, new hydrophilic aerogel is also prepared in addition to conventional hydrophobic aerogels for the future explore to the aqueous satellites. The TNP2EP panel for organic compounds and microorganisms exposure experiments. In the exposure experiments in Tanpopo, it has been suggested that the wavelength range of the irradiated light may have an important effect on the survival of cyanobacteria. Therefore, some cut-off filters are added in the front of cyanobacteria sample and improved the sample configuration in the microorganisms exposure experiments in Tanpop2. Vaporization pressure and VUV spectra of amino acids and

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related compounds were thought as important factors for the survival of organic compounds. Therefore, we decided to conduct new exposure experiments of amino acids and their related compounds in consideration of the addition of a film to prevent evaporation and, UV wavelength dependency. In addition, dialanine was found in the exposure experiment of alanine. This was the first result of the condensation of amino acid in the space environment. In order to further confirm the peptide formation in space and to develop the progress of the peptide formation reaction, some combinations of amino acids are exposed in the space environment in Tanpopo2. In the former QCC experiments, quenched carbonaceous composites were exposed in the space environment with and without windows in order to evaluate the effects of high-energy particles and UV irradiations. In this time, QCC, nitrogen-included QCC, simulated interstellar organics, carbonaceous chondrites, chondritic IOM, and analog material of chondritic organic matter are exposed. Through these experiments, this mission aims to understand the evolutionary history of organics and to infer the origin and evolution of life in our solar system.