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Stability of Amino Acid-Related Compounds in Space -Preliminary Results of the Tanpopo Organic Exposure Experiment-

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Introduction: Presence of a wide variety of organic compounds in extraterrestrial bodies such as carbonaceous chondrites suggested that they delivered organic compounds to the primitive Earth in prior to the generation of the terrestrial life. It was suggested that cosmic dusts delivered much more organics to the primitive Earth than meteorites and comets, but presence of bioorganic compounds in cosmic dusts have been unclear, since they have been mostly collected in terrestrial biosphere.

The Tanpopo Mission is the first astrobiology space mission utilizing the exposed facility of JEM, ISS [1]. The mission includes collection of cosmic dusts and space exposure of amino acid-related compounds (free amino acids and their precursors) in order to examine possible delivery of extraterrestrial amino acid-related compounds by cosmic dusts. The mission started in May 2015, and the first sample returned to the Earth in August 2016 after about 1 year's exposure in space. The other samples will retune to the Earth in 2017 and 2018, after 2 or 3 years' space exposure. Here we report the first analytical results of the organic exposure experiment in the Tanpopo Mission.

Experimental: The following five materials were selected for the space exposure: (i) $^{13}C_2$-glycine, (ii) $^{13}C_5$-isovaline, (iii) $^{13}C_3$-hydantoin (a precursor of glycine), (iv) $^{13}C_6$-5-ethyl-5-methylhydantoin (a precursor of isovaline) and (v) products by proton irradiation of a gas mixture of ^{13}CO, NH_3 and H_2O (hereafter abbreviated as *CAW*). CAW is a mixture of complex organic compounds including amino acid precursors [2]. Each material was added to one of dimples on an aluminum plate, dried, and then covered with hexatriacontane. Each plate for space exposure was covered with a SiO_2 or MgF_2 window. The same kind of plates were prepared for (i) dark controls (exposed in space but no light allowed), (ii) cabin controls (stored in the JEM cabin), and (iii) ground controls.

VUV was monitored with an alanine dosimeter [3], and optically stimulated luminescence dosimeter (OSLD) and silver activated phosphate glass dosimeter (RPLD) were used to monitor space radiation. Exposure panels with the aluminum plates and dosimeters were attached to an ExHAM module together with capture panels to collect dusts with ultra-low density silica aerogel [1], and exposed on the Exposed Facility (EF) of Japanese Experimental Module (JEM) of ISS.

The material in each dimple was collected by using small amount of methanol and water. Amino acids were determined by HPLC. Amino acid precursors and CAW were determined after acid-hydrolysis. The materials were also analyzed by GC/MS and LC/MS. Preliminary results will be reported.

References: [1] Yamgishi A et al. (2009) *Trans. JSASS Space Tech.* 7: Tk49-55. [2] Takano Y et al. (2004) *Appl. Phys. Lett.* 84: 1410-1412.. [3] Izumi Y et al. 2011 *Orig. Life Evol. Biosh.* 41*:* 385-395.