# Current status of developments by the collaboration team with ESCuC/JAXA for curation works and analysis of Hayabusa2 returned samples

M. Uesugi[1], M. Ito[2], N. Tomioka[2], K. Uesugi[1], A. Yamaguchi[3], N. Imae[3], T. Ohigashi[4], Y. Karouji[5], T. Yada[6], and M. Abe[6],
*[1]Japan Synchrotron Radiation Research Institute (JASRI/SPring-8) (uesugi@spring8.or.jp), [2]Japan Agency for Marine-Earth Science and Technology (JAMSTEC), [3]National Institute of Polar Research (NIPR), [4]Institute for Molecular Science (IMS), [5]Tokyo Metropolitan University, [6]Japan Aerospace Exploration Agency (JAXA).*

Extraterrestrial sample curation center (ESCuC) of Japan aerospace exploration agency (JAXA) organized a special team for the development of techniques and devices for the handling, transfer and analysis of samples returned by Hayabusa2 spacecraft, from 2015 under the agreements of collaboration. The special team constitutes of members of institutes those having state-of-the-art analytical instruments and experiences of curatorial works of precious natural samples, but beyond the specialists of the extraterrestrial materials. Through the collaboration, we can introduce latest specialties and knowledges from diverse scientific and technological fields into the processes of analysis of Hayabusa2 returned samples [1,2].

So far, we finished the development sample transfer container for the inter-institute transfer, even international transfer of samples, without contamination of terrestrial materials and sample damages such as breaking and sample lost. We also evaluated the sealing performance of the container and confirmed that it has enough sealing performance against even positive pressure inside the container. The container, named as Facility to Facility Transfer Container (FFTC), is already available commercially.

Currently, the team members are working for (1) development of sample holders for the sample transfer in high cleanness environment, (2) development of devices for the atmosphere shielding environment for the sample handling, (3) development of sample holders applicable for multiple analytical methods, and (4) development of techniques for the evaluation of cleanness of those developed materials and environments. Although those devices and techniques are still under development, we already applied them for the analysis of samples in each institute, and evaluated its applicability and problem for the analysis of Hayabusa2 returned samples.

We also started development of new analytical protocols of extraterrestrial materials, which includes method of sample transfer, sample separation and data sharing, through the rehearsals of the curation works for the initial description of Hayabusa2-returned samples using extraterrestrial materials. Currently, 5 Antarctic micrometeorites provided by national institute of polar research (NIPR) were imaged by synchrotron radiation computed tomography (SR-CT) and x-ray diffraction (XRD) at SPring-8, and investigated by high resolution field emission scanning electron microscopy and energy dispersive spectroscopy (FE-SEM-EDS) system at institute for molecular sciences (IMS). Through the series of non-destructive analysis, we selected Antarctic micrometeorites those having similar characteristics of carbonaceous chondrites, and formed thin sections by focused ion beam (FIB) for the characterization of organic materials by scanning transmitted x-ray microscopy and near edge x-ray absorption fine structure analysis (STXM-NEXAFS) at IMS, high resolution analysis by transmission electron microscopy (TEM), and isotopic analysis of light elements such as hydrogen, carbon, nitrogen and oxygen by secondary ion mass spectrometry (SIMS) at Japan agency for marine-earth science and technology (JAMSTEC).

In order to make possible such large scale collaboration for the series of sample analysis between institutes, we need to evaluate sample damages and contaminations through the analysis, and develop the methods for cleaning of sample holder and protocols for suppressing sample damages, as well as sample transfer system. Sample holders are already under the examination. So we can start the evaluation of cleanness and development of method for the cleaning of them by ultrasonic cleaning and acid-alkali cleaning [3,4]. We will start the development in this year, and will report the result near future.

Thus progress of our development is going along quite smoothly. We can share the result of our development with preliminary examination team of Hayabusa2 sample analysis organized by Hayabusa2 project, and can make their start process faster.

In future work, we will develop the cutting method of samples with low-contamination processes, including sample mounting devices and handling method after the cutting. In order to include rare and trace element analysis using laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) in our protocol, we will also start the development of sample holders and examination of it, in parallel with the rehearsals of the initial description of Hayabusa2 returned samples.

**References**

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