A REPORT ON THE PREPARATION STATUS OF THE CURATION PROTOCOL FOR HAYABUSA2 SAMPLE

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We present an interim report on the returned sample curation protocol of Hayabusa2 project.

Hayabusa2 spacecraft was launched in 2014, and currently en route to a C type asteroid, called Ryugu, that is expected to be rich in organic compounds and water-bearing minerals. Hayabusa2 is the second asteroid sampling project of JAXA and has the following scientific and engineering objectives. The scientific objectives are to investigate chemical characteristics of the C type asteroid, especially the mineral – water – organic interactions by researching and analyzing its subsurface materials, and thereby to gain insight into its internal structure and reaccumulation process in its formation history. The engineering objectives are to mature the technology, which had been developed for the past Hayabusa mission, by improving its robustness, reliability and operability, and to execute the first impact experiment on the asteroid surface [1]. In 2018, Hayabusa2 will begin remote-sensing observations over the surface of Ryugu, fire metal impactors to excavate its surface and perform touchdowns for collecting its surface and/or subsurface materials. Hayabusa2 will leave Ryugu by 2019 and carry the sample, stored in vacuum-tight containers, back to Earth in December 2020. Later, the containers will be transported to the Extraterrestrial Sample Curation Center (ESCuC) in JAXA.

ESCuC is fully responsible for curating all the returned sample of Hayabusa2 and contribute to the Hayabusa2 project through the curation work. We believe that the curation of extraterrestrial samples is a critical interface between sample return missions and international science communities [2]. To accomplish our role, we have set following goals in our curation protocol:

- Handling the returned sample without any contamination as possible;
- Providing primary information about bulk returned sample and Ryugu grains obtained in the curation for the Hayabusa2 project researchers and other scientists;
- Creating the database of collected Ryugu grains.

The first goal is obvious, but is most important for ensuring a correctness and maximum output of scientific information about the asteroid to be obtained from the returned sample. Especially so, since the source of the sample is identified unambiguously unlike meteorites, which is an utmost advantage of the sample return mission. The goal depends seriously on the curating work in ESCuC. Therefore, the curation protocol must reduce risk of terrestrial contamination as possible, as well as prepare for every conceivable contingency.

Primary information about the returned sample, including the total weight and the size distribution of Ryugu grains and their physical and chemical states are very important for scientists to properly plan their researches and request suitable samples. In case any contamination was detected in the returned sample, the level of contamination and when it happened is critical not only to the scientists but also to the engineers who designed the spacecraft to improve the sampling system for future missions. The chemical and physical properties of Ryugu sample are necessary information for us to optimize the allocation procedure of the sample and would be interesting and informative to the scientists when they are designing research plans. We are planning to use 5% of the returned sample for preliminary examination to obtain necessary data to characterize physical and chemical properties of the returned sample. The sample allocation on request will also inform researchers of the size, weight and surface state (e.g., IR spectra) of the requested samples. We have just started selecting analytical instruments and designing analytical procedures in our curation protocol. Part of the analysis should be consistent with the Goal-1 defined previously and/or ensure no interruption in the allocation process.

As already noted, we are responsible for curating all the returned Ryugu sample. We are now developing a nomenclature for pieces of the sample or grains that are collected from the container. We will create a database for the grains, including necessary information such as their names, physical properties and histories of removing procedure that occurred during curation and after allocation as well. Such database would facilitate management of the collected grains and allow scientists to access all information they need.

We are still considering the best way to curate the returned sample of Hayabusa2 and recognize that there is room for further improvement in the current curation protocol.

References: [1] M. Yoshikawa, S. Watanabe and M. Abe (2012) Mission planning document of Hayabusa2, Section 2.3 the Mission Objectives. in Japanese; [2] C. Allen, J. Allton, G. Lofgren, K. Righter, R. Zeigler, and M. Zolensky (2013) Curating NASA's Extraterrestrial Samples. EOS Transactions American Geophysical Union., 94, 253-260.