From Hayabusa to Hayabusa2 - the present status and plans for the sample curations of the sample return missions by JAXA

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The asteroidal samples returned from Itokawa in 2010 by the Hayabusa spacecraft have been curated in the Extraterrestrial Sample Curation Center (ESCuC) by the Astromaterial Science Research Group (ASRG) of JAXA until now [1]. Thus far, almost 600 of Itokawa regolith particles have been handpicked one by one with an electrostatically-controlled micro-manipulator inside the clean chamber of purified nitrogen condition and described by FE-SEM/EDS without exposing to air. Their BSE images and EDS spectra are open in public at the website of the ASRG (https://hayabusaao.isas.jaxa.jp/curation/index.html), and they are available for world-wide researchers via international announcement of opportunity (AO) since 2012. As a result, more than 200 of them have been distributed to more than 50 approved research proposals so far. We are planning to finish the initial descriptions of rest of Itokawa particles from the Hayabusa sample catcher until 2020.

On the other hand, Hayabusa2 will reach the target C-type asteroid Ryugu in 2018, this year, perform a series of remote-sensing observations and sample recovery on its surface, and then leave Ryugu in 2019 to return the recovered samples to the Earth in 2020 [2]. For the curation of the returned samples by the Hayabusa2, the ASRG has developed a new clean room next to that of Hayabusa-returned samples and new clean chambers which will be installed inside the clean room in collaboration with an advisory committee for specification of Hayabusa2 sample curation facility. The clean chambers for Hayabusa2 are composed of five parts, CC3-1, 3-2, 3-3, 4-1, and 4-2, the former three for vacuum processes and the latter two for those in purified nitrogen conditions. We plan to unclose the sample container of Hayabusa2 and extract the sample catcher in the CC3-1, then transfer to the CC3-2 to unclose the catcher and obtain some fraction of the samples inside the catcher in vacuum. Then the catcher will be transferred to the CC3-3 to be purged in purified nitrogen condition and further sent to CC4-1 and 4-2 to be observed by an optical microscope, weighed by a balance, and all the samples in there to be extracted for their initial descriptions.

The construction of the clean room has been finished in the last summer, and the clean chambers will have been installed in to the clean room until next summer. From the next fall, the ASRG will start functional checks of the clean chambers and perform a series of rehearsals for the reception of the returned samples in collaboration with the sampler team and the initial analyses team of the Hayabusa2 project. After the series of rehearsals, the chamber will be recovered to be ready for the reception of the returned samples.

At the end of 2020, Haybusa2 will return its reentry capsule including the asteroidal samples to the Australia. The capsule will be recovered from its landing site immediately, and we will extract the sample container from the capsule to be cleaned in its outer surface at the facility nearby the landing site and connect it with a gas extraction system, with which gas inside the container will be captured in gas cylinders. After that, all of them will be returned to Japan to be transferred to the ESCuC, and the sample container will go through the series of processes as shown above. After half a year of initial descriptions of the samples, some part of them will be distributed to the initial analyses team and analyses facilities in collaboration with JAXA and analyzed for a year. A year after the sample return, some fraction of them will be also distributed to NASA, based on the memorandum of understanding (MOU) between JAXA and NASA. Then some fraction of the rest samples will be available to world-wide researchers for further analyses after one and half year since the sample return.

References: [1] Yada T. et al. (2014), Meteorit. Planet. Sci. 49, 135. [2] Watanabe S. et al. (2017) Space Sci. Rev. 208, 3.

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