FROM HAYABUSA TO HAYABUSA2: PRESENT STATUS AND PLANS OF CURATORIAL WORKS FOR JAXA'S ASTEROIDAL SAMPLE RETURN MISSIONS.

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Introduction: The new era of sample return missions had started since the Stardust returned samples from comet 81P/Wild 2 in 2006 [1], followed by the Hayabusa spacecraft from the near-Earth S-type asteroid 25143 Itokawa in 2010 [2,3]. In this year, Hayabusa2 will reach its target body, the near-Earth C-type asteroid 162173 Ryugu [4], and also OSIRIS-REx toward the near-Earth B-type asteroid 101955 Bennu [5]. Additionally, several other sample return missions have been planned recently, such as the Martian Moons eXplorer (MMX) for the Phobos and/or Deimos [6], the CAESAR for 67P/Churyumov-Gerasimenko [7], and the HELACLES for the the Moon [8]. Therefore, returned-sample curation is increasing its importance in those sample return missions, in order to maximize scientific gains of their missions. The Astromaterial Science Research Group (ASRG) of JAXA has been managing curatorial works of Hayabusa-returned samples since its return in 2010, and preparing for sample curation of Hayabusa2 samples, which is planned to be returned in 2020.

Present status of curatorial works for Hayabusa-returned samples: Major advantages of the returned samples by missions compared with meteorites and cosmic dust found on the Earth are contamination control against the terrestrial environment and identification of their sampling bodies and positions. In order to keep these advantages of Hayabusa-returned samples, the ASRG developed the clean chambers in ultra-pure nitrogen or ultra-high vacuum conditions not to expose samples to the terrestrial atmosphere and contaminate them with the terrestrial detritus grains. They are installed in a cleanroom of class better than 1,000 in Fed. Std. 209E [3]. Environments of both the cleanroom and clean chambers have been monitored periodically by silicon wafers exposure method assisted by chemical analyses with a thermal decomposition GC-MS and a vapor-phase decomposition ICP-MS [9]. We installed an electrostatically controlled micro-manipulator in the clean chamber, which have been used for handling particles of 10-300μm in size, recovered from the sample container returned by Hayabusa. Additionally, the particles have been transfer to the FE-SEM/EDS for initial description using a sealable sample holder without exposing to air. Then they have been given their own ID numbers and listed on the database, which is open in public on the website of the ASRG (https://curation.isas.jaxa.jp/curation/hayabusa/index.html). More than 700 particles have been given IDs so far, and most of them are available for the international announcement of opportunity of research, which had started since 2012 and is still going on. We plan to finish initial descriptions of whole the Hayabusa-returned samples until 2020.

Preparation status of curation for Hayabusa2-returned samples: In parallel with the curatorial works mentioned above, the ASRG has developed clean chambers for Hayabusa2-returned samples in cooperation with advisory committee of specification of curation facility for Hayabusa2-returned samples. A new cleanroom of class 1,000 had been established in last summer, in where new clean chambers for Hayabusa2-returned samples will be handled. The new clean chambers (CCs) are basically composed of five components; 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 the samples in there to be extracted for further descriptions. The final parts of CCs (CC3-3, 4-1, and 4-2) are now under installation. Then the ASRG will start their functional checks after their installations, followed by a series of rehearsals for initial processes of the returned samples, which will continue until the Hayabusa2 sample return in 2020, in cooperation with the sampler team and the initial analyses team of the Hayabusa2 mission.

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