A perspective of Phase 2 Curation "Team Kochi" for Hayabusa2 returned sample: *in-depth* analysis of a single grain utilizing linkage microanalytical instruments

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Analyses of returned samples from asteroid [1] and comet [2] were essential to understand their origin and nature as well as increasing our knowledge about the Solar System. The most recent returned sample was from the S-type asteroid Itokawa by Hayabusa mission in 2010. The results by series of researches provided new insights for the connection to meteorites, space weathering processes, small asteroidal body formation in the Solar System [e.g., 1, 3, 4]. JAXA Hayabusa2 and NASA Osiris-REx are both current sample return missions from the organic-rich asteroids, Ryugu (C-type) and Bennu (B-type), respectively [5, 6]. Both missions have complementary scientific goals that are to understand the Solar System evolution in the point of view of organics, water, and associated minerals.

Phase 2 curation teams will be acting under the scientific direction and strong ethic of the Astromaterial Science Research Group (ASRG) of JAXA and was authorized 2 institutes by the steering committee of the ASRG in 2017: (1) Kochi Inst. for Core Sample Research, JAMSTEC in collaboration with JASRI/SPring-8, UVSOR/Inst. Molecular Science, National Inst. Polar Research and Tokyo Metropolitan University, and (2) the Inst. for Planetary Materials, Okayama University at Misasa. The JAXA Curation requested us to make an *in-depth* analysis of few grains by our *state-of-the-art* instruments/techniques and nationwide corroborative research abilities. We will conduct on analyses in parallel with the initial analysis team led by the Hayabusa2 project.

Here are our policies as Phase 2 curation team:

1) We will analyze Hayabusa2 samples utilizing the *state-of-the-art*, original analytical and research in collaboration with several institutes and universities to acquire petrological and chemical characteristics to the utmost. Our results and developed techniques are fed back to the initial analysis teams, and will be a benchmark that contributes to the international announcement of opportunity and curation works.
2) We will acquire a 2D / 3D high resolution texture of a single grain, molecular structures, chemical species identifications, light element isotopic ratios, major and trace elemental abundances, microtextural features, and crystal structures. To make this successfully we will apply the sequential analysis protocol from non-destructive analyses at synchrotron radiation facility such as 3D-CT and XRD, STXM-XANES to destructive analyses such as FIB sample preparations, TEM observations and mass spectrometry with SIMS, LA-ICP MS.
3) We will explore *in-depth* of Hayabusa2 samples from the viewpoint of similarities or different characteristics with the current knowledge of extraterrestrial materials (meteorites, micrometeorites, Hayabusa samples) in Antarctic Meteorite Center of National Inst. Polar Research and JAXA curation facility. Primary objective will focus on studying of extraterrestrial water and primordial organic components in Hayabusa2 samples.

Avoiding terrestrial contaminations (i.e., atmospheric water/air, organics) during sample curation, transportation and analysis are important to obtain original chemical characteristics of Hayabusa2 samples. We, then, have developed novel and universal sample holders for a linkage analysis utilizing micro-analytical instruments of FIB, TEM, STXM and NanoSIMS minimizing terrestrial contaminations and sample damages of lost or broken. We also made an additional sample holder (namely Okazaki cell) for STXM analysis (Ohigashi T. et al. i*n preparation*), and a sample transport vessel (FFTC: facility to facility transfer container) under vacuum or inert gas (Uesugi K and Uesugi M. et al. *in preparation*) in parallel.

We will report current status of "Team Kochi" of Phase2 Curation and our developed universal sample holders for FIB, TEM, NanoSIMS, STXM, and a sample transport vessel under vacuum or inert gas among nationwide/international universities and institutes.

References

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