PRESENT STATUS OF HAYABUSA-RETURNED SAMPLES – INITIAL DESCRIPTIONS, INTERNATIONAL AOs AND CONSORTIUM STUDIES. T. Yada[1], M. Abe[1,2], M. Uesugi[1], Y. Karouji[1], T. Okada[1,2], Y. Ishibashi[1] and M. Fujimoto[1,2,3], [1]Insti. Space Astronautical Sci. and [2]Lunar Planet. Explor. Program Group, JAXA, JAPAN, [3]Earth-Life Science Institute, Tokyo Institute of Technology, JAPAN. (yada@planeta.sci.isas.jaxa.jp).

Introductions: Hayabusa spacecraft returned its reentry capsule to the Earth in June 2010 [1]. Particles have been recovered from its sample catcher [2], and some of them were distributed for initial analyses, which clarified that they must originate from the surface of S-type asteroid 25143 Itokawa [3-8]. As the Extraterrestrial Sample Curation Team (ESCuTe) of JAXA continued to describe samples recovered from a sample catcher of Hayabusa, we have described more than four hundred particles. Some parts of them have been distributed to NASA, international announcement of opportunity (AO) research and JAXA for consortium studies and promoted studies, and others have been preserved for future analyses. Here we report the present status of the initial descriptions, the international AOs, and the consortium studies for Hayabusa-returned samples.

Present status of initial descriptions: As reported previously, the Hayabusa-returned particles have been recovered mostly from quartz glass disks, which had been attached to the openings of both room A and B of the catcher and gathered particles inside the catcher by tapping [2]. The samples recovered from the glass disks have been placed in a special sample holder to seal the samples without exposure to atmosphere and analyzed in the low vacuum mode of a FESEM without conductive coating. After the FESEM-EDS analyses, they are sent back to the clean chamber and put on each of grids of quartz glass slides one by one for preservation.

We continued to described particles from a cover of room B in 2013. At first, they were described as the same manner with those on the glass disks. After July 2013, we started to use a special SEM holder for the room B's cover in order to observe particles on it directly with the FESEM-EDS for initial descriptions. So far, more than 70 particles are newly described, although they have not been given their IDs. We are going to publish information about initial descriptions for the newly described particles in the 3rd international AO, which will be published in the beginning of fiscal year 2014.

International AO:

In January 2013, 2nd international AO was published and their proposals submission was ended up in March 2013. After a series of discussion in the international AO committee, 15 proposals have been selected and announced in June 2013, and allocated samples have been distributed to the selected researchers after the announcement.

In October 2013, JAXA hosted an international symposium for Hayabusa-returned samples and related topics, named "Hayabusa 2013: Symposium of solar system materials", in which some of the results of the international AOs were presented.

Consortium studies: Some types of Hayabusa-returned samples show rare features which are too precious to be occupied by only one research group. The ESCuTe has started consortium studies of such rare types of Hayabusa-returned samples in the beginning of 2013. So far, four consortium studies are ongoing as presented in [9-11].

The one is for RA-QD02-0136-01, which is currently the largest sample of Hayabusa-returned samples recovered from the sample catcher (Fig. 1a). The major axis of the particle, r_a, is around 310 μm, and weight of the particles is estimated around 20 μg, assuming the volume $V = 4/3\,\pi\, r_a r_b r_c \sim 4/3\,\pi/(2\sqrt{2})r_a^3$ and density of the particle as 3.4 g/cm^3 [8]. The RA-QD02-0136-01 is mainly composed of Ca-rich pyroxene, and also contains minor amount of low-Ca pyroxene, olivine, plagioclase and troilite. The surface of the particle is in irregular shape, and showing variable structure such as large crystal base and aggregation of small particles. Because of its large volume and large surface area, studies related to detection of cosmogenic components, Ar-Ar dating, space weathering have been proposed by several research groups.

The second is for RA-QD02-0129, which is a silicate particle containing NaCl on its surface (Fig. 1b). Its major axis is around 40 μm, and those of NaCl range from 3 to 5 μm. Because NaCl is rare in planetary material samples, this sample is scientifically important. The first priority of this consortium is to prove extraterrestrial origins of NaCl, and the second is to clarify its origin whether it would be originated from Itokawa parent bodies or not. In order to comfort these objectives, searching for trace of solar wind irradiation are proposed to be studied.

The third ones are those containing phosphates (Fig. 1c). Results of their initial descriptions indicated that they contain Ca-phosphate. Because Ca-phosphate tends to be enriched in incompatible elements like U and REEs, we propose the investigation of U-Pb systematics using Nano-SIMS in order to study the history recorded in the phosphates. We will perform the U-Pb dating of the phosphates as many as possible and aim to understand the thermal history of Itokawa parent

body such as crystallization age and the catastrophic collision if recorded.

The fourth is for RA-QD02-0245, composed mainly of FeS (~40 μm) with smaller olivine and pyroxene grains embedded in the FeS (Fig. 1d). We believe that chemical composition of this particle should be analyzed. Especially, the siderophile element composition gives us information on the formation process of Itokawa parent body. Additionally, space-weathering effect on FeS surface will be examined by TEM in detail.

Proposals for these consortium studies were once closed in last October, and participants of each consortia discussed for their research schemes until this December. Once the plans would be fixed, preparation for analyses will begin from January 2014.

Future plans for initial descriptions, international AOs and consortium studies: For the initial descriptions of Hayabusa-returned samples, we are now developing metal disks to recovered particles inside the catcher on them and observe particles on their surfaces directly with the FESEM-EDS. We expect that the new recovery media might increase efficiency of initial descriptions for particles. In 2014, we will start recovering particles from a rotational cylinder of the catcher, utilizing a metal disk for it. Then we will recover particles from a cover of room A, and perform thorough recovery from the catcher room A and B. In this plan, we schedule to finish to recover particles from the catcher in fiscal year of 2015.

After the 3rd international AO in 2014, we plan to hold it periodically until we would finish to recover particles from the catcher. Then we are planning to hold it not periodically, but eventually, depending on researchers' requests and securement of a certain amount of preserved fractions for future analyses.

There is a possibility that any rare type of particles other than those mentioned before will be discovered in the course of initial descriptions in future. As anything would be discovered, we would announce a new consortium study to receive proposals for its analysis plans.

References: [1] Abe M. et al. (2011) *LPS XXXXII,* #1638. [2] Yada T. et al. (2014) *MAPS,* in press. [3] Nakamura T. et al. (2011) *Science* 333, 1113. [4] Yurimoto Y. et al. (2011) *Science 333,* 1116. [5] Ebihara M. et al. (2011) *Science 333,* 1119. [6] Noguchi T. et al. (2011) *Science 333,* 1121. [7] Tsuchiyama A. et al. (2011) *Science 333,* 1125. [8] Nagao K. et al. (2011) *Science 333,* 1128. [9] Uesugi M. et al. (2013) *76th Ann. Meteorit. Soc. Meeting,* #5186. [10] Yada T. et al. (2013) *76th Ann. Meteorit. Soc. Meeting,* #5150. [11] Karouji Y. et al. (2013) *76th Ann. Meteorit. Soc. Meeting,* #5148.

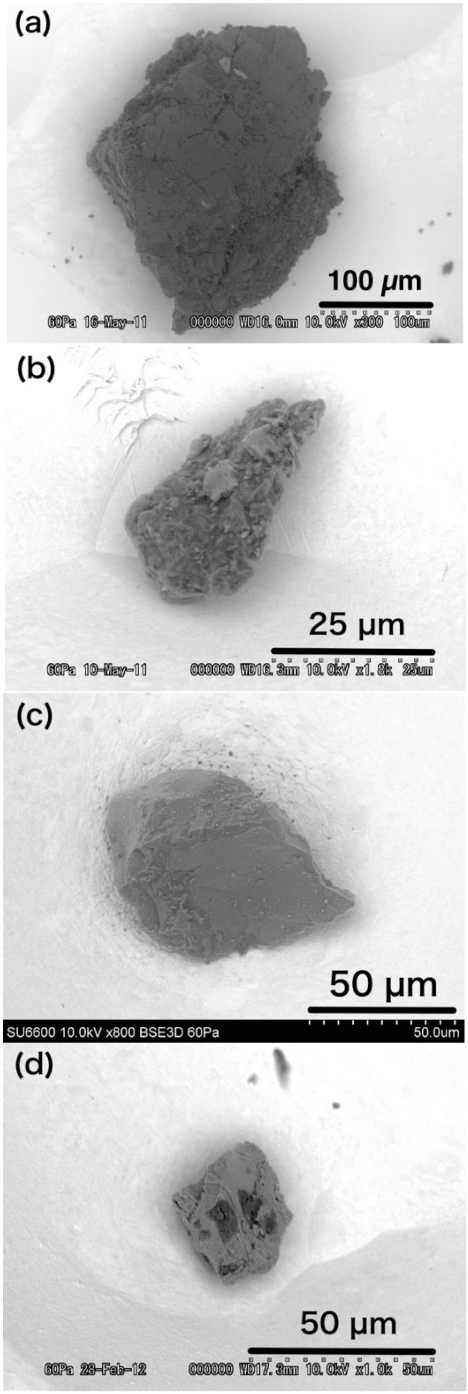

Fig. 1. Backscattered electron images of particles for consortium studies. (a) RA-QD02-0136-01, a particle of the maximum size, 310 μm in major axis. (b) RA-QD02-0129, that containing NaCl. Its major axis is 40 μm. (c) RB-CV-0025, one of those containing Ca-phosphate. Its major axis is 91 μm. (d) RA-QD02-0245, that mainly consists of iron sulfide. Its major axis is 40 μm.