CURRENT STATUS OF THE CONSORTIUM STUDY FOR HAYABUSA-RETURNED SAMPLE: RB-QD04-0040 CONTAINNIG Fe-S-Ni PHASE.

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Introduction: Hayabusa samples have been catalogued at Extraterrestrial Sample Curation Center (ESCuC) of JAXA [1], and some of them have been allocated to the preliminary examinations, international AOs, and NASA. However, some particles are not allocated to the international AOs because of their rare characteristics. These rare particles are under investigations as the consortium studies lead by the member or the previous members of Astromaterials Science Research Group in ESCuC [2-6]. We proposed a particles, RB-QD04-0040 bearing Fe-S-Ni phase as a new consortium study last year. Since no other Itokawa sample contains the phase with silicate grains, this particle that may indicate a new variety of Itokawa surface materials is rare and valuable. After we called proposal in some international conferences [7-9], we have been discussed about the research plan to maximize scientific gain. In this paper, we show the plan and results of the rehearsal as the current status of our consortium study.

Research plan: RB-QD04-0040 was collected from 1st touch down site on Itokawa surface, and it is mainly consists of olivine and plagioclase (74 μm) with tiny Fe-S-Ni phase (<3 μm). Our motivation of this consortium study is to identify mineralogy of the Fe-S-Ni phase. If this phase was the pentlandite single crystal, it can be the first discovery of the aqueous alteration product from the Hayabusa samples. For the first observation of space weathering effect on the pentlandite, air-unexposed environment is required during its handling. Therefore, we will coat the particle with epoxy in globe box under pure N_2 atmosphere at JAXA. After the epoxy coating, the particle will be examined by Synchrotron X-ray diffraction (S-XRD) analysis at KEK BL-3A to characterize the phase [10]. Then, Synchrotron radiation CT (SRCT) will be carried out at SPring8 BL-47XU to determine the internal structure and the phase distribution [11]. We will plan to divide the particle into 2 samples by FIB, one is a TEM foil including pentlandite-like phase, and another is remaining major silicate region. TEM observation of pentlandite-phase can tell us how space weathering affected on the aqueous alteration product. STEM observation will be also performed for the detail observation, especially the coexisting minerals. The remain region will be polished for electron microprobe analysis and Nano SIMS analysis. The chemical and oxygen isotopic compositions may give us clues to understand the origin and the evolution process of RB-QD04-0040.

Current status: Handling rehearsal of the tiny particle was performed in globe box under pure N_2 atmosphere at ESCuC in August 2016. Some particles 50-70 um in size were prepared from Kilabo LL6 chondrite for the practices. We picked a particle up by 5 um in a diameter carbon fiber with epoxy resin, and then heated it by hotplate to fix under optical microscope. Since environment in globe box made from acrylic plastic is dry, static electricity has a strong influence. Even we used epoxy, some particles were lost during handling. We tested and found the best viscosity of epoxy resin for safety handling of the sample.

During FIB of the particle coating with epoxy, we expected that it is too difficult to know where the pentlandite is on the particle surface because charging effect may occur. However, it could be seen easily after carbon coating on the particle. Besides, SEM-BSE images are able to compare with the images obtained by SRCT as shown in Fig1.

RB-QD04-0040 will be picked up from the storage glass slide in chamber 2 at ESCuC in October. S-XRD and SRCT will be carried out in November. We will present the preliminary result of these analyses.

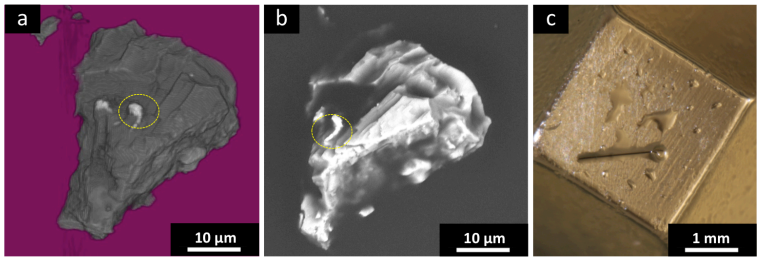

Fig. 1. Rehearsal using Kilabo particle. (a) 3D image of the sample obtained by SRCT. Some phases consisting of heavier elements show bright color. (b) BSE image of the same sample as in (a). (c) An image taken by optical microscope of the same sample. The sample was mounted on the potted butts with epoxy before C-coating.

References: [1] Yada et al. 2015. *78th MetSoc, #5215*. [2] Uesugi et al., 2014. *77th MetSoc, #5226*. [3] Yada et al., 2013. *76th MetSoc, #5150*. [4] Karouji et al., 2014. *77th MetSoc, #5240*. [5] Hashiguchi et al., 2015. *78th MetSoc, #5193*. [6] Matsumoto et al., 2015. *78th MetSoc, #5194*. [7] Nakato et al., 2015. *78th MetSoc, #5191*. [8] Nakato et al., 2015. *The Annual Meeting of Japanese Society for Planetary Sciences, #P035*. [9] Nakato et al., 2015. *Hayabusa 2015: Symposium of Solar System Materials*. [10] Nakamura et al., 2001. *Goldschmidt Conference, #3490*. [11] Tsuchiyama et al., 2013. *Geochimica et Cosmochimica Acta, 116, 5-16*.