

## **Current status and future plans of the preliminary examination of Category 3 particles of Hayabusa-returned samples.**

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**Introduction:** Preliminary examinations of the carbonaceous materials of Hayabusa-returned samples, Category 3, was performed in parallel with those of silicate materials by the Hayabusa sample preliminary examination team (HASPET), from early 2010. In the beginning of the examinations, we consider that small pieces of viton gloves used in the clean chamber 1 and 2 would be the most probable origin of category 3 particles. However, as the number of category 3 particles increased, we found variety of textures and chemical compositions of category 3 particles by FE-SEM observations. The variation would indicate multiple origins of the carbonaceous materials. Consequently, we could not obtain any meaningful data from the analysis during the first preliminary examinations. The HASPET and Extraterrestrial sample curation team (ESCuTe) of JAXA restarted the examination with improving sample handling methods and procedure for the sequential study. In this paper, we summarize the result of the analysis obtained so far, and discuss future plans for the determination of possible origins of category 3 particles.

**Procedure of the study and future plan:** Samples allocated for the preliminary examinations of category 3 are RA-QD02-0008, RA-QD02-0120, RA-QD02-0180, RB-QD04-0001, RB-QD04-0037-01 and RB-QD04-0047-02. RA-QD02-0008 was lost during the manipulation at first preliminary examination. Three samples, RA-QD02-0120, RB-QD04-0001, and RB-QD04-0047-02, were analyzed by the nano-SIMS, in order to investigate the isotopic anomaly which is the direct evidence of the extraterrestrial origin. All three particles, however, showed the terrestrial value of H, C and N isotopic ratio [1]. Because the samples were flattened on the Au plate, we could obtain the spectra of FT-IR and micro-Raman spectroscopy with enough signal-to-noise ratio. In parallel with the Hayabusa-returned particles, we processed observation and analysis of insoluble organic matters (IOM) of A881458 (CM2) and several possible materials for the origin of category 3, such as viton and vectran. It seems that, however, the peak features of the category 3 particles were differ from all the spectra of those materials.

After those analysis, RA-QD02-0120 was sliced into ultra-thin sections by FIB equipped to the Extraterrestrial sample curation center, and in order to observe by TEM/STEM at JEOL. ToF-SIMS analysis of RA-QD02-0180 and RB-QD04-0037-01 will be also performed after pressing on the indium plate prior to the nano-SIMS analysis. Currently we prepared for those analyses with determining the possible effect on the subsequent analyses, such as sample damages and contaminations. The result of the investigations will also be reported in other presentations [1-2] and subsequent papers in detail.

**References:** [1] Ito et al. 2013. Abstract of Hayabusa Symposium, this issue [2] Uesugi et al. 2013. Abstract of Hayabusa Symposium, this issue.