COMPOSITIONAL CHARACTERIZATION OF THE HAYABUSA2 RETURNED SAMPLES WITH MICROMEGA, WITHIN THE CURATION FACILITY.

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Introduction: The pioneering sample collection operation from a C-rich asteroid has been successfully performed by the ISAS/JAXA Hayabusa2 mission [1]. The samples are planned to depart from Ryugu late 2019, and arrive on Earth about a year later. Immediately after its recovery on Earth, the return capsule will be brought to ISAS, in Sagamihara (Japan), to enter a dedicated curation facility. It will be opened under vacuum, and samples will be extracted and transferred, through X-Y stages and gloveboxes, onto sample holders to be characterized, prior to be eventually distributed to selected initial analysis teams. The clean chamber in the curation facility is made of several contiguous compartments, in which either ultravacuum or ultrapure N_2 filling will be maintained. As a major feature of this global characterization, a purely non-destructive analysis of the composition of the samples, down their grain scale, will be performed, by means of near-infrared hyperspectral imagery, thanks to the MicrOmega instrument.

MicrOmega: It constitutes a fully integrated hyperspectral microscope, mounted on a flange equipped with a sapphire window so as to image samples maintained within the clean chamber in the curation facility, either under vacuum or with N_2 filling. The sample holders will be mounted an a X/Y/Z translation stage, so as to position the samples in focus within the 5x5 mm^2 large MicrOmega field of view (FOV). MicrOmega will then build 3D (x,y, λ) image-cubes, in 256x256 pixels, thus providing a spatial sampling of 20 µm. It will thus enable to image at once a number of grains, while acquiring for each of them its entire spectrum. The spectral dimension will be obtained by piling up monochromatic images of the entire FOV, covering the spectral range (0.99 to 3.6 µm) in ~350 contiguous spectral channels, 20 cm^{-1} large. This will be performed by illuminating sequentially the samples with a monochromatic beam, selected by an AOTF (Acousto-Optic Tunable Filter) tuned at a given RF frequency [2] : by scanning the RF frequency of the acoustic signal, the output wavelength covers the full spectral range 0.99 and 3.6 µm, chosen to contain diagnostic featres of most constituents of interest: minerals, both igneous and altered, as well as aqueous phases and organics. This AOTF dispersive system offers several advantages, with a high sensitivity and full flexibility to choose and possibly oversample (down 2 cm^{-1}) wavelengths of interest.

A fully resolved (spatial/spectral) image-cube will be acquired in typically 20 minutes, including the cooling of the MCT detector matrix, while providing a SNR > 100 over the entire spectrum.

Designed and developed at IAS, MicrOmega will constitute a facility instrument, integrated within the overall plan of activities performed under ISAS/JAXA lead to receive, handle, characterize, store and distribute the samples colleted at the surface of Ryugu, for a broad international community.

References:

[1] Watanabe S. et al. 2019, *Science*:eaav8032 DOI: 10.1126/science.aav8032. [2] Bibring et al. 2017, *Astrobiology*, 17, 6 and 7, DOI: 10.1089/ast.2016.1642