First NIR hyperspectral imaging of Hayabusa2 returned samples by the MicrOmega microscope within the ISAS Curation Facility

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Introduction: On December 6, 2020, the Hayabusa2 mission successfully returned to Earth ~ 5.4 g of samples collected at the surface of the C-type asteroid Ryugu [1,2]. Its surface was first sampled on February 22, 2019, then on July 11, 2019, close to a 15-meter large artificial crater, so as to possibly access sub-surface material [3]. The collected samples are now kept at the Extraterrestrial Samples Curation Center of JAXA at ISAS in Sagamihara, Japan, for a first round of preliminary analyses, with the objective of characterizing in a non-destructive manner both the bulk samples and a few hundreds of grains extracted from them [4]. In particular, the goal is 1) to support their further detailed characterization by the international Initial Analysis Teams, and 2) to build a catalogue of the grains, accessible to the international community through AO selection, starting mid-2022.

Methods: The preliminary characterization of these samples is being conducted with a visible microscope with five color filters, a FTIR spectrometer operating in the 1-4 µm range, and MicrOmega, a hyperspectral NIR microscope developed at Institut d'Astrophysique Spatiale (Université Paris-Saclay/CNRS, Orsay, France), operating in the near-infrared range (0.99-3.65 µm) [5]. This is the first time that preliminary analyses of returned extraterrestrial samples include a characterization by a NIR hyperspectral microscope.

Results: Preliminary outcomes of the analyses performed with MicrOmega will be presented. In particular, the representativity of the samples collected by the Hayabusa2 spacecraft will be addressed through the comparison of the spectra obtained by MicrOmega and of the NIRS3 remote sensing IR spectrometer [6] which performed a spectral characterization (1.8-3.2 µm) of Ryugu's surface, including the sites of the samples' collection [7,8].

At a global scale, all bulks exhibit similar features, with a dominant OH- 2.7 µm component and a 3.3 – 3.5 µm band centered around 3.4 µm. Their variation at different spatial scales and significance will be presented. Specific signatures, detected in grains typically present in <1% of the pixels, but of high relevance regarding the processes determining Ryugu formation and evolution, will also be presented and discussed.

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