MICRO-FT-IR HYPERSPECTRAL SURFACE CHARACTERIZATION OF INDIVIDUAL RYUGU GRAINS: MATRIX COMPOSITION AND SPACE-WEATHERING EFFECTS.

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Sample-return space missions allow us to investigate materials from outer space with state-of-the-art laboratory techniques [1]. Constraining the material mineralogical and physical properties enables us to better understand their parent bodies' history and our Solar System [2, 3]. JAXA's Hayabusa2 mission [4] acquired spectroscopic data and samples from primitive body C-type asteroid Ryugu. Samples originate from two collect sites (A: surface, C: presumably sub-surface). Here, we look for spectral differences across the surface of individual grains to assess mineralogical differences and identify possible effects of space weathering (i.e., an ensemble of processes affecting the surface of airless bodies, which alters their surface spectral, elemental, and morphological properties [5]). Our samples comprised three mm-sized grains (two samples from site A and one from site C): A0226-1, A0226-2, and C0242 [6]. Grain A0226-2 separated from A0226-1. We characterized the samples' surface via micro-FT-IR hyperspectral imaging in the mid-IR (2-16 μm) to probe the spatial distribution of phyllosilicates, anhydrous phases, and organic matter.

The investigation is currently ongoing. A widespread hydrated silicate phase dominates the surface matrix, dotted with carbonates. We see no significant spectral variations at the scale of the individual grain for A0226-1 and C0242. However, fragment A0226-2 showed a localized region exhibiting spectroscopic features with a slight red-shift in peak position (+7 nm for the 2.7 μm hydration feature, +40 nm for the 10 μm silicate feature), accompanied by a decrease in band area and an increase in bandwidth to the average spectrum of A0226-2. These spectral changes are compatible with those induced by solar-wind ion implantation from space weathering [7, 8]. The accidental detachment of A0226-2 from A0226-1 may have exposed fresh surfaces from the grain's interior, allowing us to investigate weathering effects across the surface of an individual grain. Supplementary analysis will be led at a smaller scale using field-emission scanning electron microscopy to probe elemental and morphological differences related to space weathering on an individual grain.

[1] Hiroi, T. *et al.* (2023), *Icarus*. [2] Nakamura, T. *et al.* (2023), Science. [3] Brunetto, R. *et al.* (2023), *ApJL*. [4] Watanabe, S. *et al.* (2019), *Science*. [5] Brunetto *et al.* 2015, *Asteroid IV.* [6] ASRG, ISAS, JAXA *et al. (2022).* [7] Hiroi, T. *et al.* (2023), *Icarus*. [8] Le Pivert-Jolivet, T. *et al.* (2023), *Nature Astronomy*.