Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.38043

Spectral and Microstructural Characterization of Returned Bennu Samples

LISETTE E. MELENDEZ[1], HUNTER VANNIER[1], MICHELLE S. THOMPSON[1], LINDSAY P. KELLER[2], LAURA B. SEIFERT[2], BRIONY H. N. HORGAN[1], PROF. HAROLD C. CONNOLLY JR., PHD[3] AND DANTE S. LAURETTA[4]

[1]Purdue University
[2]NASA Johnson Space Center
[3]Rowan University
[4]University of Arizona

Samples returned from near-Earth asteroid (101955) Bennu by NASA's OSIRIS-REx mission provide an opportunity to investigate how the spectral, microstructural, and chemical characteristics of carbonaceous asteroidal regolith are modified due to their exposure to the space environment [1]. Global remote sensing observations of Bennu's surface reveal a blue spectral slope across visible- to near-infrared (VNIR) wavelengths, while fresh craters and laboratory spectra of returned material exhibit a comparatively redder slope [1,2]. To explore this discrepancy, here we conduct a coordinated study via reflectance spectroscopy and electron microscopy techniques for grains from bulk sample OREX-800068-0. We obtained hyperspectral VNIR (0.4-1.0 μm) and shortwave infrared (SWIR; 0.96-2.5 μm) spectra for 100 particles (with diameters of 0.5-1 mm) from bulk sample OREX-8000068-0 using a HySpex spectrometer system, producing image cubes at resolutions up to ~30 and 40 μm/pixel (VNIR/SWIR). Back-scattered electron (BSE) and secondary electron (SE) images along with corresponding energy-dispersive X-ray spectroscopy (EDS) elemental maps were collected using the Hitachi TM4000Plus II scanning electron microscope (SEM) to explore grain chemistry and microstructure.

Each grain was categorized based on spectral slope, morphology (angular, hummocky, or mottled, following [1]), and surface texture. The surface of each grain was examined in the SEM to search for evidence of space exposure (i.e., space weathering) in the form of micrometeoroid impact craters and melt splashes. A majority of the spectra collected from the particles exhibit flat, mildly red slopes, similar to [3]. However, six particles with strong blue slopes were identified. Some of these grains exhibit evidence of microcratering across their surface. We will present further characterization of the microstructural and chemical properties of these grains and their corresponding spectral properties. This study advances our understanding of the factors that influence laboratory spectroscopic measurements of carbonaceous samples and contextualizes the sample within Bennu's global properties.

[1] Lauretta D.S. and Connolly, H.C., Jr. et al. (2024) *MAPS, 59,* 2453-2486. [2] Hiroi, T. et al. (2025) *LPSC LVI,* abstract #1331. [3] Milliken, R. E. et al. (2025) *LPSC LVI,* abstract #1550.