

BENNU SURFACE SAMPLES RETURNED BY OSIRIS-REx CONTACT PADS

L. P. Keller¹, L. B. Seifert¹, M. S. Thompson², C. J. Snead³, and T. M. Erickson⁴, H. C. Connolly Jr.^{5,6,7} and D. S. Laurretta⁷, ¹XI3, NASA JSC, Houston 77058 (Lindsay.P.Keller@nasa.gov). ²Dept. of Earth, Atmospheric and Planetary Sciences, Purdue Univ., West Lafayette, IN; ³XI2, NASA JSC, Houston, TX; ⁴Amentum, NASA JSC, Houston, TX; ⁵Dept. of Geology, Rowan Univ., Glassboro, NJ; ⁶Dept. of Earth and Planetary Sciences, American Museum of Natural History, New York, NY; ⁷Lunar and Planetary Laboratory, Univ. of Arizona, Tucson, AZ.

Introduction: NASA's OSIRIS-REx spacecraft returned a 'bulk' ~122 g sample of regolith particles from the surface down to ~0.5 m in depth from Hokioi crater on (101955) Bennu [1]. The spacecraft's Touch-and-Go Sample Acquisition Mechanism (TAGSAM) also included 24 contact pads consisting of stainless-steel Velcro, each ~17 mm in diameter and arranged symmetrically around the circumference of the TAGSAM base. The purpose of the contact pads was to sample Bennu's uppermost regolith to explore the mineralogical, chemical, and spectroscopic changes resulting from exposure to space weathering [2]. During preliminary examination by the science team, analyses of the particles from a single allocated contact pad revealed space weathered surfaces with microcraters and quenched impact melts deposits [3]. Here we report on the morphology of additional particles from the contact pad analyzed by [3] and particles extracted from a second contact pad, focusing on the space weathering effects they record.

Sample and Methods: We analyzed particles from two contact pads, OREX-452000-0 (Pad #18) and OREX-437000-0 (Pad #13) using optical microscopy and scanning electron microscopy (SEM) imaging. Four particles from OREX-452000-0 were described previously [3] and an additional four particles are described here; two trapped in the Velcro loops and two particles extracted from the base weave, which consists of woven stainless steel yarn bundles, leaving gaps up to ~200 nm between strands (Figure 1). There were no trapped particles observed in the Velcro loops in OREX-437000-0, however, several particles 100-200 μm in size were trapped in the weave. We extracted 13 of these particles from OREX-437000-0 using a tungsten needle and placed them on conductive tape for SEM analyses. Both contact pads also have abundant loosely bound fine-grained (<50 μm) dust particles coating much of the pad's surface area (loops and weave, Figure 1).

Results and Discussion: All 13 particles from OREX-437000-0 and 7 of 8 from OREX-452000-0 show direct evidence for space weathering (microcraters and impact melt deposits), whereas only ~10-20% of particles analyzed in the "bulk" sample show similar features [3]. Image analysis of particles at the sampling site shows that OREX-452000-0 could have contacted both angular and hummocky rocks, while the location where OREX-437000-0 contacted was in shadow [4]. The particles from OREX-452000-0 all show angular morphologies, and OREX-437000-0 includes both angular (~2/3) and hummocky (~1/3) morphologies (Figure 1). The two pads sampled different regolith material with OREX-452000-0 having large particles trapped in the loops but few particles trapped in the weave, whereas OREX-437000-0 has tens of trapped particles in the weave but none in the loops. Parts of OREX-437000-0 have mm-sized clusters of fine-grained, candidate hummocky material on the weave that was likely crushed onto the contact pad during sampling.

Conclusions: Over 95% of the particles analyzed from two contact pads show evidence of space weathering in the form of microcraters and impact melt deposits. The impact melt deposits are of particular importance because they contain numerous FeS and FeNiS nanoparticles that are known to influence spectral properties [5]. Continued work on the contact pad particles provides important constraints on space weathering rates and for interpreting the spectral properties of Bennu from remote sensing observations.

Acknowledgements: This research was supported by NASA under Contract NNM10AA11C issued through the New Frontiers Program. Electron microscopy was performed in the Electron Beam Analysis Labs at NASA JSC. LBS acknowledges support through the NASA Postdoctoral Program administered by Oak Ridge Associated Universities.

References: [1] Laurretta, D. S. & Connolly, H. C. *et al.* (2024) *MAPS* 59, 2453. [2] Bierhaus, E. B. *et al.* (2018) *Space Sci. Rev.* 214, 107. [3] Keller, L. P. & Thompson, M. S. *et al.* (2025) *Nature Geo.* 18, 825. [4] Jawin, E. R. *et al.* (2023) *JGR-Planets*, 128, e2023JE008019. [5] Thompson, M. S. *et al.* (2026) this meeting.

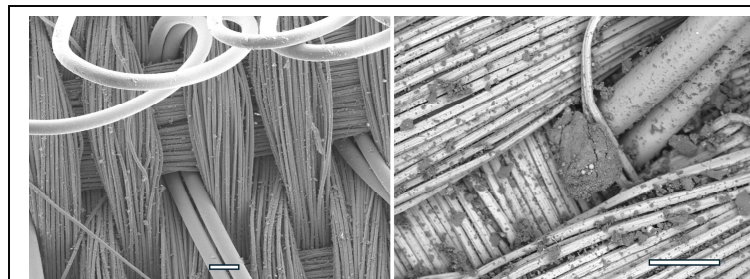


Figure 1. SEM image from OREX-452000-0 (left) showing fine-grained particles in the weave. The SEM image (right) shows a hummocky morphology particle trapped in the weave of OREX-437000-0. Scale bars are 100 μm .