THE OSIRIS-REX SAMPLE CATALOG

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Introduction: The OSIRIS-REx spacecraft collected material from near Earth asteroid Bennu at the Nightingale sample site inside of Hokioi crater on October 20, 2020. The touch-and-go sample acquisition mechanism (TAGSAM) head was stowed into the sample return capsule (SRC) shortly after sample collection following the recognition that some sample was exiting the TAGSAM head. This sample was delivered to Earth on September 24, 2023 when the SRC landed at the Utah Test and Training Range (UTTR). The heat shield, back shell, and other components of the SRC were removed in a temporary cleanroom at UTTR on landing day, as well as placing the interior science canister, (with the TAGSAM head inside) onto a flow of curation nitrogen gas (nitrogen purge). On September 25, the following day, the science canister on nitrogen purge was flown from Utah to Houston and only removed from nitrogen purge immediately before it was placed into the airlock of a glovebox in the OSIRIS-REx curation lab at Johnson Space Center [1] that day. On September 26, the canister lid was removed inside of a glovebox, which revealed asteroid sample outside of the TAGSAM head on the avionics deck ranging from fine-sized dust to mm-sized particles. After which, the most intense parts of preliminary collection documentation and initial sample processing began.

Sample Catalog: The development of the initial content for the OSIRIS-REx sample catalog includes two main components:

Advanced Imaging and Visualization of Astromaterials (AIVA) Team systematic documentation: At pre-determined steps throughout the disassembly and processing, the AIVA team performed specialized high-resolution archival documentation of the flight hardware and returned sample to preserve these first views for posterity and research [2]. These AIVA image products provide higher quality and higher resolution imagery than routine curation processing imagery. Over the last eleven years, the AVIA team has developed advanced documentation and visualization methodologies for imaging NASA's astromaterials samples to enhance conservation and curation protocols [3]. All the AVIA imagery was collected while the flight hardware and samples were inside of gloveboxes and where all lighting and camera equipment remained outside of the gloveboxes. Imaging is challenged by glovebox geometries that limit camera angles and by uncontrollable specular reflections and color shifts caused by both the glovebox's windows and mirror-finish interior. Due to constrained working distances and the size of the subject, focus stacking was identified as a necessity to achieve heightened focus detail across the entire image-scene.

Processing Documentation and containerization of individual samples: Asteroid samples are named according to the hardware location they were collected from [4]. Most OSIRIS-REx asteroid samples are from inside the TAGSAM head and therefore have OREX-800000-series names (fine-sized dust to cm-sized particles). The parent sample or hardware area for each sample is photographed before the sample is removed and placed in its container and then again after the sample has been removed. The container for each sample is weighed empty prior to receiving its sample and then samples are weighed inside their container. Each sample is photographed inside of its container, unfortunately, some of the long-term storage containers are not conductive to photographing samples well because of their depth and mirror finish. The OSIRIS-REx asteroid samples initially fall into two sample types: particles and aggregates. A particle is an individual coherent rock. An aggregate sample includes multiple particles and frequently includes more particles than can be reasonably counted. The catalog includes a macroscopic description that is from direct visual observation in cleanroom through the glovebox. The length, width, and height of large particles (> 5 mm in size) are measured inside the glovebox to the nearest mm. The collection and manipulation of Bennu samples inside of glovebox requires careful sample processing using techniques that have been refined since the sample arrived at Johnson Space Center [5].

Future Catalog Updates: The OSIRIS-REx sample catalog will be updated with each edition of the Astromaterials newsletter. The OSIRIS-REx catalog will steadily increase in both breadth and depth for the foreseeable future. The number of samples in the catalog will increase as more are separated, documented, and containerized to support approved sample requests and transfers, both directly and indirectly. In addition, more information about some samples currently in the catalog will be added, such as, collection of more x-ray computed tomography (XCT) scans on pristine OSIRIS-REx particles.

References: [1] Righter et al. (2023) Meteoritics & Planetary Science 58 (4), 572-590 [2] https://curator.jsc.nasa.gov/osirisrex/aiva_images_listing.cfm [3] Blumenfeld et al. (2019) *LPI Contrib. No. 2132* Abstract #3056 [4] Lunning and Righter (2022) *LPI Contrib. No. 2695* Abstract #*6295* [5] Plummer et al. (2024) *Meteoritics & Planetary Science* this volume.