Planning for OSIRIS-REx Sample Analysis

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The OSIRIS-REx spacecraft arrived at the near-Earth asteroid (101955) Bennu in December 2018. After operating in proximity for a year, a primary site was selected, and in October 2020, the spacecraft successfully collected a sample. It departed Bennu in May 2021 and is scheduled to return the sample to Earth in September 2023.

The OSIRIS-REx mission will bring back various types of samples, including bulk regolith, surface particles adhering to contact pads, witness coupons, the sampler head, and the sample return capsule. The asteroidal material is expected to range in particle size from sub-micron to 3 cm and will be categorized based on size into fines, intermediate, coarse, and large particles. Abundant hydrated silicates, carbonates, magnetite, and organic components are predicted based on remote sensing data. The sample may contain different types of lithic components, such as chondrules, CAIs, and matrix, similar to those found in carbonaceous chondrites. Bennu's surface contains rare material that is non-chondritic and igneous in nature, which may also have been collected. Extensive brecciation was observed at meter-scales, and it is likely to occur at centimeter and finer scales in the sample delivered to Earth.

The sample will be analyzed to determine the history of Bennu and its components and precursor asteroid(s). The OSIRIS-REx Sample Analysis Plan (SAP) provides a framework for the science team to meet the Level-1 mission requirement, which includes analyzing the sample to determine the asteroid's presolar history, formation age, nebular and parent-body alteration history, relation to known meteorites, organic history, space weathering, resurfacing history, and energy balance in the regolith.

The SAP establishes a hypothesis-driven framework for coordinated sample analyses, defines analytical instrumentation and techniques, and outlines plans for Sample Analysis Readiness Testing. It also provides guidance for the transfer of samples from curation to the sample analysis team, describes the data storage, management, retrieval, and archiving system, and establishes an analysis strategy for different amounts of returned sample, including rare or unique lithologies.