Cosmochemistry in Support of OSIRIS-REx Mission Objectives

DANTE S. LAURETTA[1] AND THE OSIRIS-REX TEAM

[1]Lunar and Planetary Laboratory, University of Arizona – lauretta@lpl.arizona.edu

The **O**rigins, **S**pectral **I**nterpretation, **R**esource **I**dentification, and **S**ecurity–**R**egolith **Ex**plorer (OSIRIS-REx) sample return mission will survey near-Earth asteroid (101955) Bennu to understand its physical, mineralogical, and chemical properties, assess its resource potential, refine the impact hazard, and return a sample of this body to Earth. This mission launches in 2016, encounters Bennu in 2018, and returns the sample to Earth in 2023.

Our dynamical models constrain the thermal and space-weathering history of Bennu's surface [1, 2]. This history can only be verified through analysis of the returned sample. Analysis of cosmogenic isotope ratios, thermal modification signatures, radionuclide abundances, and nuclear track densities will constrain the dynamical evolution of the parent asteroid and test the hypotheses developed by dynamical studies of Bennu.

OSIRIS-REx will also develop a comprehensive thermophysical model of the asteroid using data obtained during the asteroid encounter. The thermal conductivity and heat capacity of the returned samples will be directly measured in the laboratory. These fundamental physical parameters, combined with the state of the regolith on the asteroid surface, drive the thermal inertia [3] and the resulting strength of the YORP and Yarkovsky effects [4].

Analysis of the OSIRIS-REx returned sample will also improve the interpretation of remote sensing data, including radar astronomy [5], photometry [6], astrometry, spectroscopy [7], and scattering properties at all wavelengths. We will analyze the returned material to develop a body of knowledge about the spectroscopic and dielectric properties of asteroid regolith that will enable us to place Bennu samples in the appropriate context. We will also use knowledge about Bennu regolith from returned samples to understand variations in the astronomical properties of other objects. Sample return from this object will provide enormous benefit to future astronomical studies of near-Earth objects as well as main-belt asteroids.

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