Global Geology of Bennu from NASA's OSIRIS-REx Space Mission

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NASA’s OSIRIS-REx sample return mission has been studying near-Earth Asteroid (101955) Bennu since December 2018 to understand the nature of this body and to support site selection and sample acquisition. This effort has produced a wealth of data with which to constrain its geologic history. Here we report on the global geology of Bennu based on analyses of images combined with shape, mass, and slope measurements. Bennu is a 500-m-diameter object with an oblate spheroidal shape and an equatorial bulge that is similar to other near-Earth asteroids, including Ryugu, as observed by the Hayabusa2 sample return space mission. Candidate impact craters have been observed at a range of diameters, reaching up to 150 m, across the surface of Bennu. An apparent concentration of large craters at low latitudes suggest that the equatorial ridge is stratigraphically old.

The population of boulders is diverse, with many of the largest boulders being darker than the average surface albedo and exhibiting a hummocky texture. A smoother and brighter class of boulders occurs at smaller sizes, and the populations are mixed throughout the surface. Notably there is a distinct lack of very large boulders in the equatorial region (+/− 25 deg.). Only 2 of the 16 boulders larger than 30 m are located in this band. Patterns of apparent mass movement across the surface suggest movement from the mid-latitudes towards the equator. There is evidence of imbrication in the local downslope direction, as well as evidence of mass movement at smaller particle sizes in the form of partial burial of boulders and pileup of boulders at locations downslope of scarps. Many of these signatures are found specifically in regions with high surface slope and in regions where the surface slope would have increased substantially as the asteroid experienced its observed increase in spin rate. The spatial distributions of craters, boulders, observed particle ejection events and signatures of mass movement suggest a dynamic recent history in some regions of Bennu’s surface, and we use these data to divine information about the most mobile elements of its surface and their? relation to the history of Bennu’s equatorial ridge.

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