

Evidence of Mass Movement and Boulder Transport on Bennu from NASA's OSIRIS-REx Space Mission

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The near-Earth Asteroid (101955) Bennu is currently being studied by the NASA OSIRIS-REx mission. This small, top-shaped asteroid has evidence of a diverse suite of geologic units, including impact craters, linear features, and abundant boulders at a range of sizes, geometric albedos, and morphologies. The surface of the asteroid appears to be old; however localized evidence of mass movement has been detected in various locations that suggests the surface is dynamic. The abundance of boulders on the surface varies widely with location, with concentrations of boulders located in local topographic lows (e.g. the interior of candidate impact craters, between linear ridges), suggesting that boulders travelled across the surface to result in these concentrations. Several locations that are abundant in boulders show evidence of imbrication in the local downslope direction, but evidence of imbrication is more localized than on other asteroids such as Itokawa. Evidence of mass movement at smaller particles sizes is also evident by burial of boulders: evidence of largescale W-E movement of material and burial of rocks has been identified, as well as pileup of boulders at locations downslope of scarps. In addition, the largest boulder on Bennu (~95 m diameter) appears to be partly buried, with a portion of the boulder of unknown size remaining in the subsurface. This boulder has an exposed face that extends vertically off the surface by ~20 m, suggesting that several tens of meters of finer-grained material could have accumulated to bury part of the boulder. The direction that material would have traveled to bury this boulder follows the regional slopes. As a comparison, the second largest boulder on Bennu (~50 m diameter) that is nearby albeit at a slightly higher latitude (45 S latitude, versus the buried boulder at 25 S latitude) is not buried –rather, this boulder appears to be perched on the surface. The variation in very large boulder burial suggests the surface of Bennu has potentially experienced large-scale material transport.

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