Search for Candidate Exogenous Material on Bennu using MapCam and PolyCam Images

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Introduction: Exogenous material has been reported on asteroids (101955) Bennu and (162173) Ryugu. The albedo, color, and spectra of six bright boulders on Bennu show that they are distinct from the rest of Bennu's comparatively dark surface and are likely basaltic material from asteroid (4) Vesta (DellaGiustina et al. 2019; 2020). Bright boulders identified on asteroid (162173) Ryugu show absorptions near 1 μm but not near 2 μm, suggesting olivine-rich anhydrous silicates (Tatsumi et al., 2019; 2020).

Methods: In this work, we used images of Bennu obtained by the MapCam and PolyCam instruments (Rizk et al. 2018; Golish et al. 2020) on NASA's OSIRIS-REx spacecraft (Lauretta et al. 2017) to search for more potentially exogeneous material on the surface of Bennu.

Results: We identified approximately 50 bright boulders on Bennu with significant x-band (0.85 μm) absorptions, including the six bright boulders previously described in DellaGiustina et al. (2020). These bright boulders are distributed across Bennu's surface, concentrated in terrains with larger than average particle size. The boulders exhibit three main morphologies (homogeneous, heterogenous, and breccia) and three spectral types (reflectance peak at 0.55 μm, flat, and reflectance peak at 0.7 μm). There is some correlation between the morphology and the spectra. More specifically, three of the four boulders with reflectance peaks at 0.55 μm are in the breccia category and one is in the heterogeneous category, whereas all the boulders with reflectance peaking at 0.7 μm fall in the homogeneous and heterogenous categories. Bright boulders with reflectance peaking at 0.55 μm have lower normal albedo than the other two spectral groups, suggesting a different composition and possibly a different origin. An initial comparison with Ryugu (Tatsumi et al. 2019) indicates that Bennu is more abundant in possible exogeneous material.

Discussion: Further analysis of MapCam and PolyCam images has revealed a wider diversity of potentially exogenous lithologies on Bennu, expanding on the findings of DellaGiustina et al. (2020). We continue our study of this diversity of material on Bennu's surface to constrain the asteroid's origin, evolution, and collisional history (e.g., Ballouz et al. 2020).

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