WHAT CAN THE ORIENTATIONS OF BENNU'S BOULDERS TELL US ABOUT ITS EVOLUTION?

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Introduction: Boulder populations on Solar System bodies are the net result of the evolutionary processes that have taken place on their surfaces to date. Catastrophic impacts and high-energy events will organize surface boulders more randomly than a series of small-scale events like local micrometeorite impacts, distant larger impacts, thermal quakes, and local avalanching. The power that such small-scale events have to reshape a surface depends on their frequency, seismic efficiency, and how often they are erased by high-energy events. Here we look for boulder orientations as signatures of small-scale events, which may relate to the seismic efficiency and thus the internal structure of the subsurface.

Boulder identification and characterization has been underway since October 2018 and will continue until sample site selection in late 2019. A preliminary analysis of boulder orientations was conducted on PolyCam images (33 cm/px) of asteroid Bennu taken on December 1, 2018, over a region that spans 20° of longitude and about 100° of latitude (around 5% of the surface). This region was chosen to include some specific features of interest and may or may not be representative of the surface as a whole. In this work, boulders are identified with ellipses.

This preliminary dataset shows evidence of a trend for boulders to be oriented with their long ends along the north-south direction (**Fig. 1**, cyan), which corresponds to the global sloping direction, also aligned north-south [1]. Further, this figure shows that if we weight the "value" of each boulder by its elongation, the case for this preferential boulder orientation becomes stronger (**Fig. 1**, purple). We compare this result to the global north-south distribution of boulder orientations. In addition, using the local dynamical slopes from the OSIRIS-REx Radio Science Working Group based upon shape models from the Altimetry Working Group [2-3], we show how boulders align themselves in relation to the local dynamic slope [4-6].

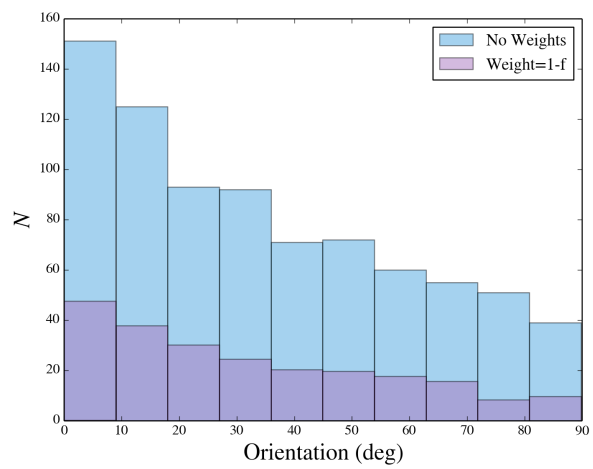

Figure 1: Distribution of boulder orientations relative to their local lines of longitude (cyan). Weighting the boulders by their elongation (f = short axis/long axis) is also shown (purple).

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