HOW UNIQUE IS ALMAHATA SITTA AND HOW RELEVANT IS IT TO BENNU?

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Introduction: The albedo diversity on the surface of asteroid 101955 Bennu is the largest observed in any asteroid. The geometric albedo ranges from 3.5% to >20% and the surface features detected so far range from centimeters to decameters in diameter. To date, similar albedo diversity among meteorites have been reported for Almahata Sitta and Kaidun; however for Kaidun the different lithologies were present within one meteorite, but the sample size was too small be used as an analog for the surface of Bennu [5]. Using a larger-scale event for comparison, Almahata Sitta was an observed fall (in 2008) that contained different lithologies within its strewn field including: ureilites, enstatites, two types of ordinary chondrites (H and L), and carbonaceous chondrites [2,4], which were linked to Almahata Sitta by their exposure histories. How rare is it to observe meteoritic falls that contain different classifications within its strewn field? We aim to make the comparison of the uniqueness seen in Almahata Sitta with the intriguing feature diversity seen on 101955 Bennu. This comparison is motivated in part by the likelihood that both Bennu and Almahata Sitta originated from the same region of the asteroid belt and may have been affected by similar processes [1,3].

Methods: We analyzed strewn fields of low albedo material in order to determine if there are xenoliths of high albedo material present among them, as is the case for Almahata Sitta. We determined the location and size of the six carbonaceous chondrite strewn fields listed in the Meteoritical Bulletin Database: Allende (CV3, fell in Mexico, 1969), Moss (CO3, Norway, 2006), Murchison (CM2, Australia, 1969), Sutter's Mill (CM2, United States, 2012), Orgueil (CI1, France, 1864), and Tagish Lake (C2 ungrouped, Canada, 2000). The meteorite candidates were mapped and narrowed down by geographic location, placement relative to each strewn field, and year of find to determine their likelihood of being a potential member of the original body.

Results: There are eight high albedo finds (ordinary chondrites, H and L) within the Allende strewn field that postdate the recorded fall. The finds have a placement that is consistent with being possible members of the Allende strewn field, although weathering of finds and exposure ages are still to be studied. No other recorded finds have been reported within the other strewn fields.

Discussion: Further investigation of the exposure ages (both the cosmic-ray exposure ages and the terrestrial exposure ages) of the individual finds within the Allende strewn field would provide valuable information to evaluate whether they could be part of the Allende fall. The fact that a large number of high-albedo meteorites have been found within the Allende strewn field, and none have been found in the other strewn fields, is consistent with the possibility that the incorporation of foreign lithologies into a carbon-rich meteoroid may not be as uncommon as previously estimated. If correct, the data would suggest that the Allende parent body was composed of multiple lithologies, similar to that of the Almahata Sitta parent body (2008 TC3), and possibly Bennu.

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