TOWARDS AN UNDERSTANDING OF INITIAL CRATER ROCK POPULATIONS: COPERNICUS CRATER VS. AVERY CRATER. S. Mazrouei[1] and R. R. Ghent[2], [1]Department of Earth Sciences, University of Toronto, Toronto, ON, Canada. [2]Planetary Science Institute, Tucson, AZ, USA.

Introduction: A new method for determining the ages of lunar Copernican-aged craters younger than roughly a billion years old has recently been established. Ghent et al. [1] documented an inverse relationship between the rockiness of large craters' ejecta, derived from the Lunar Reconnaissance Orbiter's Diviner thermal radiometer data [2], and the craters' ages. In previous work [3, 4], we used this method to date all craters with d>10 km and younger than 1 Gyr. This method assumes that all impact craters with d>10 km produce statistically similar initial rock populations, independent of their size or location on the Moon.

To determine whether the survival time of rocks varies for different rock sizes, and to distinguish how much of this rock breakdown is due to micrometeorite impacts versus other factors, we need to have a better grasp on how initial rock population in an impact varies based on the two main following factors. a) Crater size: it has been shown that ejecta sizes from an impact are proportional to the crater diameter [5, 6]. However, it is not yet known whether survival times differ for rocks of different sizes. b) Target terrain (mare versus highlands): different target strengths in an impact result in different ejecta sizes [5]. However, whether similar sized impacts produce the same initial rock size or frequency population in different terrains is yet to be determined.

In this work, we compare the ejecta rock populations of craters of similar sizes but different ages, and vice versa, both in the highlands and the maria. We do this by mapping rock locations and sizes in the ejecta blanket of several craters.

Methodology: Here, we report on preliminary results of rock counts for Copernicus Crater with a model age of ~800 Ma [e.g., 7], and Avery Crater with a Diviner rock abundance derived age of ~150 Ma [4]. Both craters are in the maria but vary in age. Due to the large size of these craters (~93km and ~11km in diameter for Copernicus and Avery, respectively), we only map rocks in three 20° wedges in different radial directions (north, southeast, and southwest) to 1 radius from the crater rim. Further explanation of the methodology can be found in [8].

Preliminary Results and Discussion: We have mapped ~2000 resolvable rocks larger than 10m in the ejecta of Copernicus. Though 10m is larger than the smallest theoretically detectable rock based on the image resolutions (generally assumed to be 2-3 pixels), we are limited by the fact that only a few NAC images exist in some parts of our large mapping areas, and our image mosaics consist of NAC frames with different incident,

emission, and phase angles. We observe a rollover in rock sizes < 20m in the preliminary size-frequency distribution (SFD) plot (Figure 1), which indicates an incomplete dataset. Similarly, we have mapped ~1350 rocks larger than 2m in the ejecta of Avery Crater, with an observed rollover in rock sizes < 4m.
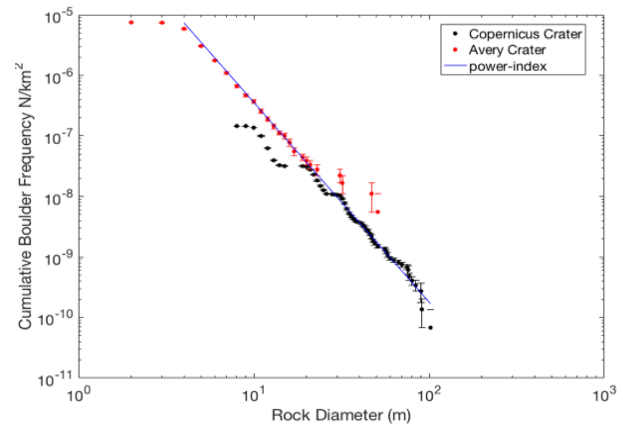

Figure 1: Rock size-frequency distribution in the ejecta of Copernicus and Avery craters.

The largest rock mapped at Copernicus is ~103m in diameter, versus ~52 m at Avery, consistent with the relationship between crater size and maximum ejected rock size. The preliminary slope derived from a linear fit to both rock populations, excluding a few outliers (rocks < 20 m at Copernicus, and 30m < rocks < 4m at Avery Crater), is ~-3.3. The similarity between these plots further shows the expected rock populations breakdown based on size. This slope is within the predicted range of -1.8 to -3.7 for lunar rocks [9]. The slope value lies within the steeper range of the previously mentioned power indices, indicating that smaller rocks are more numerous compared to larger ones.

To further determine the role of terrains, crater ages and sizes in the survival time of rocks, we will next map rocks on the ejecta blanket of similar size craters as Avery in the highlands and of an older age.

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