Determining the Age of an Unnamed Lunar Impact Crater in South Pole-Aitken Basin Using Boulder Size-Frequency Distributions. K. A. Mistick[1,2], R. N. Watkins[1], B. L. Jolliff[2], [1]Planetary Science Institute, 1700 E. Fort Lowell, Suite 106, Tucson, AZ 85719, [2] Washington University in St. Louis, Saint Louis, MO 63130. katherinemistick@gmail.com

Introduction: Understanding boulder distributions around lunar craters is important for determining how various crater properties affect the distance to which boulders are ejected and the density of boulders produced by an impact event. With this knowledge, we can estimate the age of lunar craters by comparing their boulder distributions to those of craters with known ages. The crater of interest in this study is an unnamed 3 km diameter crater ("SWMU") located southwest of Maksutov U on the far side of the Moon (41.41° S, 171.85° W). By comparing SWMU with boulder distributions from six other lunar impact craters with known ages, we attempt to constrain the age of SWMU.

Methods: We use Lunar Reconnaissance Orbiter Camera (LROC) Narrow Angle Camera (NAC) images (0.5-2 m/pix) [1], CraterTools [2] and Crater Helper Tools [3] in ArcMap to map boulder distributions. We investigated the boulder size-frequency distribution (BSFD) and compared it to BSFDs of 6 craters with known ages – Cone, North Ray, South Ray, Surveyor, Camelot, and Zi Wei [4]. BSFDs show the number of boulders at each observed size distributed around the crater. These distributions are presented using a size-frequency plot, (boulder diameter vs. cumulative frequency per count area). Distributions were analyzed according to distance from the crater rim in terms of crater radii to normalize the boulder ejection distance at each crater. Each distribution is fit with a power-law function [4].

Results: We counted 7,903 boulders in a western slice surrounding SWMU. The largest boulders occur closer to the crater rim, consistent with other studies [5-9]. The largest measured boulder was 26.9 m and occurred within 1 crater radius. The slope of SWMU's BSFD (Fig. 1) is slightly shallower than what we find at the other count sites, but it matches well with results found in previous studies [5-9].

Discussion: Comparing BSFD plots with craters of known ages provides information regarding the age of SWMU. This crater's placement within the BSFD comparison plot (Fig. 1), coupled with the presence of large boulders and a shallow BSFD slope, tells us that this crater is fairly young. Owing to the many factors influencing BSFD plots (e.g., crater size, terrain type, impact conditions), further analyses of boulder distributions around craters of a similar size to SWMU are necessary to place constraints on the age of SWMU.

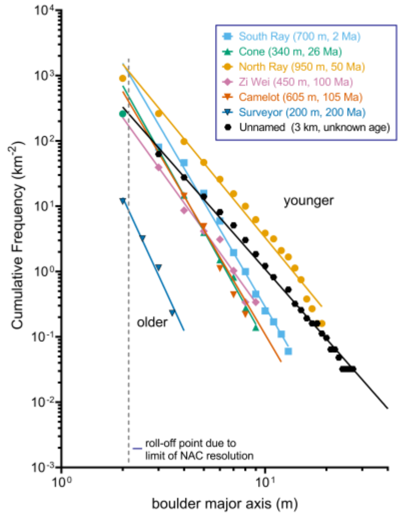

Fig. 1: Size-frequency distributions show that young craters have higher boulder populations.

Future work will involve comparison with different models, such as the model of Diviner rock abundance vs. crater age developed by Ghent [10], to continue working toward an accurate age constraint.

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References: [1] Robinson et al. (2010) *Space Sci. Rev. 150*, 81–124. [2] Kneissl et al. (2011) *PSS, 59*, 1243–1254. [4] Watkins et. al. (2018) *49th LPSC*, Abstract #1201. [5] Basilevsky et al. (2013), *PSS, 89*, 118–126. [6] Bandfield et al. (2011) *JGR 116*.[7] Shoemaker et al. (1969), *Surv. Proj. Final Report II*, 21-136. [8] Cintala and McBride (1995) *NASA TM-104804*.[9] Bart and Melosh (2010) *Icarus, 209,* 337–357.[3] Nava, R. (2011). *Crater Helper Tools for ArcGis 10.0*. [10] Ghent et al. (2014) *Geology, 42,* 1059–1062.