**FACTORS AFFECTING CRATER SIZE-FREQUENCY DISTRIBUTION MEASUREMENTS: INSIGHTS SUPPORTED BY THE LRO MISSION.** C. H. van der Bogert[1], H. Hiesinger[1], M. Zanetti[2], J. B. Plescia[3], L. R. Ostrach[4], P. Mahanti[5], H. M. Meyer[5], A. S. McEwen[6], J. H. Pasckert[1], G. Michael[7], T. Kneissl[7], and M. S. Robinson[5], [1]Institut für Planetologie, Westfälische Wilhelms-Universität, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany (vanderbogert@uni-muenster.de); [2]Western University, London, ON, Canada; [3]Applied Physics Laboratory, Johns Hopkins University, Laurel, MD; [4]NASA Goddard Space Flight Center, Greenbelt, MD; [5]Arizona State University, Tempe, AZ; [6]University of Arizona, Tucson, AZ; [7]Freie Universität, Berlin, Germany.

**Introduction:** LRO observations [*1*,*2*] provide the means to investigate smaller (<100 m) lunar features, and to count smaller diameter craters on many different terrains with the objective of defining their relative and absolute ages. Indeed, the LRO mission has helped revitalize lunar science, allowing current studies to revisit and reinterpret work done during the Apollo era, in addition to pursing new studies. In particular, a renewed effort is being made to understand the caveats and limitations of the determination of relative and absolute model ages via crater size-frequency distribution (CSFD) measurements. Here, we summarize several factors that affect CSFD measurements: illumination angle, count area size and slope, secondary cratering, and target property effects, including strength vs. gravity scaling and differential degradation effects. Updated and improved tools for measuring and fitting CSFDs [*3*-*5*], as well as for assessing crater randomness and clustering [*6*], have aided in the investigation of these factors.

**Illumination angle:** Earlier work [e.g., *7*-*9*] showed that fewer craters are visible at smaller incidence angles, where noon=0°. Using LROC data, [*10*] determined that 60°–80° incidence is ideal for consistent crater identification and measurement, and advised that similar incidence angles be used for consistent age determinations.

**Count area size:** Efforts to examine smaller features using NAC imagery has driven assessment of the smallest counting area necessary for meaningful results. Ages for small, young features have good accuracy (e.g., 10% for a 1 $km^2$ area on a 100 Ma old surface). However, old surfaces require larger minimum count area sizes, because the minimum crater diameter that can be fit with a model age increases with increasing surface age due to the increasing equilibrium diameter. Larger count areas are then required to account for the sparseness of larger craters [*11*].

**Count area slope:** Craters degrade faster on slopes, leading to a decrease in crater density with increasing slope for craters less than ~1-2 km [*12*]. Using LROC WAC images, [*13*] showed this trend holds at a slower rate for craters >~1-2 km. Because the degradation of the larger craters is dominantly controlled by gravity, rather than material properties, these craters can be used to quantify and correct the slope effect.

**Secondary cratering:** The contamination of CSFDs with both field and self- secondaries is a major concern. Not all field secondary craters (formed by subsequent primary impacts) have obvious secondary crater morphologies and their CSFDs can have similar slopes as the production function [*14*]. Estimates of the level of field secondary contamination range from 50-25% (D<200m) [*15*] to negligible [*16*]. There is also debate regarding the magnitude of self-secondary cratering (SSC) [*17*] of impact deposits formed in one primary event. SSCs could explain an excess of craters on the impact ejecta versus melt deposits, resulting in a older apparent age of the ejecta, as well as cause overestimates of the recent impact rate [e.g., *18*-*20*].

**Target properties:** The discrepancy between ejecta and melt ages may also be explained by differences in their target properties [*21*]. Craters <~1 km form in the strength-scaling regime, which can result in significant final diameter differences for contrasting target types [e.g., *8*,*15*,*21*,*22*]. It may be possible to make age corrections based on assuming different properties for the units [e.g., *23*,*24*].

**Differential degradation:** Differential degradation of craters is observable for small craters (<~250 m), particularly those in regolith. Target strength, layering, and slope effects, in addition to seismic vibrations caused by impact or tectonic phenomena cause craters to degrade (and be obliterated) at unexpected and variable rates [*7*,*25*,*26*]. This effect appears to be size-dependent for craters <~1 km diameter [*27*]. Thus, care must be taken to identify the equilibrium diameter separately for each CSFD measurement.

**Implications:** The factors discussed complicate the determination of both relative and absolute model ages. All of developments reported here, using LRO images, are also relevant to CSFD measurements and relative/absolute dating of other planetary bodies.

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