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THE CURRENT CRATERING RATE AT MARS AND THE MOON

Abstract

A direct measurement of the current cratering rate is important not only to chronology models (which use crater counting to estimate surface ages on different planetary bodies), but it is also a crucial part of understanding the risk impacting meteoric debris poses to landed and orbiting assets on other planets.

We have found >250 dated impacts that formed on Mars within the last few decades, which we use to measure the current impact rate. We limit the data to a subset of 44 new craters that were imaged before and after impact by Mars Reconnaissance Orbiter's Context Camera - a thoroughly searched data set that minimizes biases from variable image resolutions. We measure a current impact rate of 1.65 x $10^6\{tenexponentminus6\}$
craters with Deff > 3.9 meters / km^2/
year, with a best-fit cumulative power-law slope of -1.8 +/- 0.2.

This results in model ages that are four and 14 times lower than the Hartmann (2005) and Neukum et al. (2001) model production functions, respectively. This implies that applying those models to other crater populations at these diameters would result in model ages a factor of 4-14 too young. The best fit to our measurements has a shallower slope than models at these sizes, although they are within statistical errors.

More than half of the new martian impacts form clusters, so caution should be used with applying model ages to craters with D < 50 meters. Effects of clustering can be assessed by comparing the current lunar impact rate, which is not affected by atmospheric breakup. We are measuring that lunar rate by comparing Apollo orbital panoramic scans with Lunar Reconnaissance Orbiter images, resulting in the discovery of five new craters that have formed on the Moon in the last 40 years. Thus we also have the potential for a direct measurement of the Moon/Mars cratering rate ratio, which has previously only been estimated in models.