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Martian impact cratering rate over the last 3 billions years derived from layered ejecta craters dating

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All chronology models used in dating planetary surfaces are based on the lunar chronology system. The cratering density of the Moon has been calibrated with absolute ages from Apollo lunar samples. However, there are no lunar samples between 3 Gy and 800 My and only four samples have been dated between 800 My and present. Therefore, the evolution of the cratering rate after the LHB and before 3 Gy is well constrained. The cratering rate between 3 Gy and present has been assumed to be constant [1, 2]. Nevertheless, this assumption is challenged by the analysis of the geological record, such as the frequency of landslide on Mars as a function of time [3, 4]. It is therefore necessary to re-examine the validity of this assumption and place constraints on the cratering rate since the last 3 Gy.
For this purpose, we study the rate of impact cratering using small craters on a set of 53 layered ejecta craters larger than 5 km in diameter in Acidalia Planitia, Mars. LECs larger than 5km have large enough surfaces to date their formation by counting craters larger than 100m present on their blankets. Furthermore, limits of their ejecta blankets are clearly defined by a terminal bead. In order to determine the crater emplacement ages, we have applied the methodology dating described in our previous study [6] on all ejecta layers. Errors on measured ages were calculated following [7].

The age of the study area is 2.8±0.2 Gy. Our crater counts on distal ejecta blankets reveal ages younger than the age of the surrounding surface, as expected. It is essential to take into account errors on measured ages.
The statistical sample used to build this emplacement frequency distribution and our dating methodology are sufficiently reliable to deduce that a constant impact cratering rate over the last 3 Gy is not a correct approximation. The excessive number of craters emplaced 1Gy ago compared to the cratering rate used suggests a decreased impact cratering rate over the last 1Gy and the presence of one or several peaks of cratering rate (possibly associated with disruption events in the asteroid belt ?). This study confirms that the assumption of a constant cratering rate for the last 3 Gy should be revised.

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