

Lifetime of Crater Ray on the Moon

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A fresh crater on the Moon is associated with bright rays, which are made of fresh ejecta from the main and secondary craters. Rays of a lunar crater become indistinguishable from the background materials with the age, and the lifetime of a rayed crater is supposed to be about 0.8 Gyr. However, it is thought that the lifetime of the ray depends on the crater size. If it is real, the density of rayed craters ought to indicate a lack of small rayed craters. Therefore the size-frequency distribution for rayed craters gives information on the lifetime. In order to investigate the size distribution of rayed craters, using Clementine 750-nm mosaic images, we identify rayed craters on highland of the Moon. A total of 222 rayed craters which are larger than 5 km in diameter are identified in an area of about 1.41×10^7 km². The size-frequency distribution for the rayed craters indicates a lack of small rayed craters, implying that the preservation of ray depends on the crater size. The lifetime of ray of crater of 5 km in diameter is estimated to be about 0.5 Gyr., if that of the craters of 30 km is assumed to be 0.8 Gyr.

Impact gardening (i.e. a turnover of the ejecta layer) has been suggested as one of the causes for the ray obliteration. However, the spatial distribution for the rayed craters is inconsistent with the suggestion. In our previous work [Morota and Furumoto, 2003], it is shown that there is an asymmetry in the spatial distribution for the rayed craters, due to the leading-trailing asymmetry in the cratering rate. If the impact gardening were mainly responsible for obliterating rays, the density of rayed craters on the leading side would decrease and the crater densities on the leading and trailing sides should be the same. Therefore, it is unlikely that the ray is obliterated by the same types of bodies that generated the rayed craters larger than 5 km. The ray is weathered by sunlight, cosmic ray, or finer cometary particles rather than the impact gardening.