ON THE RATE OF EVOLUTION OF SMALL LUNAR CRATERS

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Craters are the predominant lunar landforms and therefore the methods of their age determination constitute a necessary aspect of the progress in lunar geology and geomorphology. The report presented deals with the rate of morphological evolution and possible life-time of small craters (diameters are between a few meters and 1-2 km). The craters described represent a continious sequence of forms characterized by different morphological sharpness. It is convenient to subdivide the sequence into 5 morphological classes: A, AB, B, BC and C (1) (see Fig. 1). In this sequence class A involves craters with the greatest relative depth and steepest walls, and class C involves shallow craters with most gently sloping walls.

The analysis performed on the intersections of craters belonging to different morphological classes shows that among the craters with the same diameters class A forms are the youngest and class C forms are the oldest. Therefore the morphological sequence from A to C is an evolutionary line (3,4) (see Fig.2). These investigations also lead to a conclusion that the less crater size the faster this crater passes from class A to class C and further on to complete destroying.

As a result of the crater intersections analysis the pairs of craters of approximately the same age have been revealed (3). These data together with available exposure age determinations for some craters at Apollo sites have been used to determine the dependence of the possible life-time of the craters from their diameter values (5) (see Fig.3). The dependence obtained is the compromise of different data, hence its idealized and averaged nature. The dependence can be used to evaluate the rate of evolution of craters imposed on horizontal or slightly sloped surfaces during the Copernician and Eratosthenian periods of lunar history. During the preceding periods characterized by more intensive meteorite bombardment the rate of morphological evolution of craters was undoubtedly higher.

Crater density counts in the hilly areas give the evidences of larger intensity of morphological evolution (and shorter life-time) for craters formed on the slopes in comparison with craters on horizontal surfaces. As it was shown in previous papers (6,7) steady-state density of craters (N_0) is proportional to the rate of crater generation (q) and their averaged life-time (τ), namely: $N_0=q.\tau$. Then analysing how steady-state craters density on slopes (N_α) depends on the steepness of the slopes (α) one can obtain the dependence of the rate of slope

THE RATE OF CRATERS EVOLUTION

A.T.Basilevsky

crater evolution (V_α) on the steepness of the slopes (α). Fig. 4 and 5 show the results of evaluation of the depemdences mentioned using the analysis of Lunar Orbiter 2,3 and Apollo 15 photographs (8). The significant shortening of life-time for craters on slopes is the evidence of essential role of downslope material displacement due to gravity in the evolution of the lunar surface. Fig.6 illustrates the joint effect of crater size (D) and steepness of cratered surface (α) on the crater life-time.

The most significant feature of the obtained craters life--time is their large values - millions of years for meter-sized craters and billions of years for craters with diameters about several hundreds of meters. The Moon is characterized by very slow (Unusual for Earth exogeneous processes) rate of morphological evolution of small landforms. The comparison lunar data with the age determinations of some Earth landforms (hilly-and-pitted relief on moraine terrain (9), Meteor crater (10) and Boltysh depression (11) shows that the average rate of destroying of small landforms on the Moon is three orders less than on the Earth.

The above mentioned evaluations of morphological rate of crater evolution were used in the geomorphologic mapping of Le Monier area for crater stratigraphy taking into account the crater sizes and the surface steepness. The obtained picture was founds to be self-consistent and fit well with other geologic data.

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THE RATE OF CRATERS EVOLUTION

A.T.Basilevsky