ON THE RELATIVE DEPTHS OF LUNAR RING MOUNTAINS AND CRATERS IN THE “SEA OF CLOUDS”

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Abstract

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ON THE RELATIVE DEPTHS OF LUNAR RING MOUNTAINS AND CRATERS IN THE "SEA OF CLOUDS"

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The determination of the relationship between the diameter D and the depth d of lunar craters and ring mountains for values of D from 200 to 2.0 km was the subject of Baldwin' s work ([1]). Comparing this relationship with the relationships for 4 terrestrial meteorite craters and for explosive pits and funnels from aerial bombs and artillery shells on the Earth' s surface, Baldwin constructed a quadratic equation for the dependence $\lg D = f(\lg d)$, which represented the measurement results fairly well:

$$\lg D = 0.1083(\lg d)^2 + 0.8035 \lg d + 0.6200; \quad (1)$$

here the values of D and d are expressed in meters.

On very detailed maps ([2]) of the region of the Moon in the "Sea of Clouds" near the impact site of the Ranger VII spacecraft, compiled from photographs of the Moon from Ranger VII, it proved possible to study small

Table 1

Map	Points	Scale	Crater diameters D, m	Number of craters
RZC1	a	1 : 1,000,000	3400–67,200	35
RZC2		1 : 500,000	3300–17,500	16
RZC3		1 : 100,000	350–1850	64
RZC4		1 : 10,000	43–360	23
RZC5		1 : 1000	8.0–28	8

Table 2

Fig. 1

Figure 1: Fig. 1

$\lg d$	$\lg D$ according to (1)	$\lg D$ according to (2)	$\lg D$ from measure-ments	Dispersion in $\lg D$
0.0000	0.6200	0.6200	0.6500	–
2.0000	2.6602	2.7592	2.7600	$±$0.2000
3.0000	4.0152	3.8186	3.9700	$±$0.2500
4.0000	5.5668	4.9728	5.5600	–

craters with diameter D up to 8 m and depth d up to 2 m, i.e., down to the dimensions of funnels from aerial bombs on the Earth.

Since both the structure of the upper layers of the lunar and terrestrial crust, and the conditions of formation of funnels from aerial bombs on the Earth and lunar crater depressions (down to the very smallest), could be different, it is important, on the basis of the new data available on the above-mentioned Ranger VII maps, to construct a graph of the dependence $\lg D = f(\lg d)$ and to verify the validity of formula (1) for smaller lunar craters.

For this purpose, in Table 1 and in Fig. 1 we have compared the values of $\lg D$ and $\lg d$ for craters according to the maps ([2]).

It turned out that within the range of values of $\lg D$ from 0.9294 to 4.1700 (or within D from 8.5 m to 148 km), the relationship between $\lg D$ and $\lg d$ was almost linear. At the same time it was found that large circus plains of the type Guerike, Fra Mauro, Parry fall outside the relationship represented by formula (1), apparently because of later lava flooding of the floors of these circuses. In addition, as shown in Fig. 1, smaller craters (Parry A, Guerike B, Landsberg, etc.) also deviate from the relationship represented by the graph.

The almost linear relationship between $\lg D$ and $\lg d$ within the range of values of the diameter D from 40 km to 8.5 m is also represented by the equation of a straight line

$$\lg D = 1.0662 \lg d + 0.6200. \tag{2}$$

For a more visual comparison with the results of calculation by formulas (1) and (2), we plotted on the graph the results of measurements of lunar craters. For values of $\lg d$, a comparison of the results of calculations by formulas (1) and (2) and of measurements is given in Table 2.

Fig. 1

From comparison of the data given in Tables 1 and 2 and in Fig. 1, we came to the conclusion that, thanks to the possibility of using in this work photographs of the Moon taken by Ranger VII, for lunar craters with diameters from 8 m to 67 km it has been established that Baldwin' s formula (1) represents rather closely the relationship between the diameter and depth of craters. Deviations from formula (1) are observed for very large cirques and those craters where, possibly, after their formation the floor was flooded by lava that welled up from within.

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CITED LITERATURE

1. R. B. Baldwin, *The Face of the Moon*, 1949.

2. *Ranger VII Lunar Charts*, RZC1–5, 1964.

3. K. P. Stanyukovich, *The Moon*, Moscow, 1960.

Note: Figure translations are in progress. See original paper for figures.