THICKNESS OF LUNAR REGOLITH AND SODERBLOM'S CRATER PARAMETER D_L.
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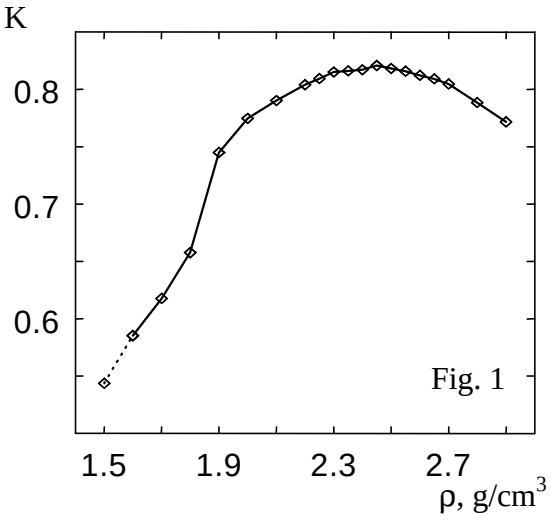
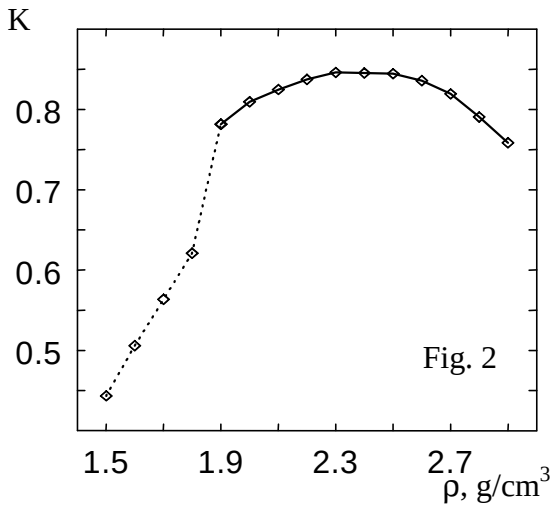
Introduction: The thickness *h* of the lunar regolith grows with time due to impacts. Parameter D_L, the diameter of a crater that would be eroded to the 1° interior slope under the impact flux, is considered also to indicate surface age [1]. Thus, a direct correlation between *h* and D_L should be observed. Here we present results of a comparison of the age parameter D_L with the regolith thickness distribution presented in [2].

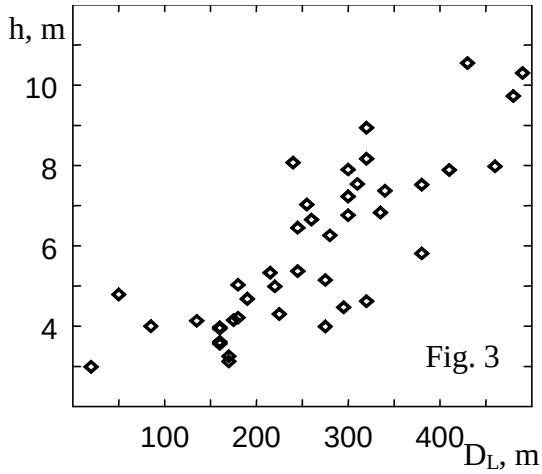
Source data: Our determination of regolith thickness *h* is based on the radar image of depolarized component at 70 cm wavelength [3] and the distribution of $FeO+TiO_2$ abundance which has been obtained from optical data [4]. We applied a model of radiowave multiple scattering in regolith layer covering the bedrock. The model has as a parameter, the mean density of the regolith layer [2]. In this work we suppose that the density is constant across the regolith layer and that the bedrock density is invariable over the lunar nearside and is 3.0 g/cm^3. For comparison we used the D_L data by Soderblom [1] for 24 light plain areas and 22 mare areas. The comparison was carried out for different values of the regolith density.

Results and discussion. At first we suppose that the regolith density for maria and highland is the same. The correlation coefficient *K* for the values D_L and *h* as a function of the mean regolith density ρ obtained for all areas and for light plain areas only are presented in Fig. 1 and Fig. 2 respectively. The curve in Fig. 1 has the highest values of about 0.82 for a density range of 0.85 at 2.3 g/cm^3. The curves parts presented as solid lines correspond to *K* values indicated the existence of





correlation between regolith thickness and D_L with the confidence coefficient of 0.95. The correlation is true for densities of equal or higher than 1.9 g/cm^3 (light plain areas) and 1.6 g/cm^3 (all areas). The results obtained with the test are reliable and very close to one obtained with stratigraphy data [2]. At the density of 2.45 g/cm^3 the average regolith thickness for maria and highlands turns out 5.16 m and 10.8 m, respectively. The same values at the density of 2.3 g/cm^3 are 5.21 m and 10.32 m. Our regolith thickness estimates *h* obtained at the ρ = 2.45 g/cm^3 are plotted against the D_L data by Soderblom [1] in Fig. 3.



The values of regolith density we obtained with the test are higher than one obtained by laboratory meas-

urements of lunar soil (about 2.0 g/cm^3 [5]). We believe the higher values of bulk regolith density can be because the regolith layer includes some rock fragments smaller than the wavelength (70 cm). The density range from 2.3 to 2.6 g/cm^3 adopted to 15%-30% volume fracture of rock inclusions (we consider the density of rocks and regolith is 3.0 g/cm^3 and 2.0 g/cm^3, respectively). Volume fracture of particles which size are or more than 1 mm at Surveyor landing sites obtained through surface rock distribution varies from 7% to 35% [6].

We studied also the case when the regolith density for maria and highlands is different. We varied the value of highland regolith density to search for the highest correlation coefficient between D_L and h. Differences between highland and mare regolith density $\Delta\rho$ are presented in Fig. 3 as a function of the mare regolith density ρ_m. It turns out that the differences are close to zero at the mare density range from 2.25 to 2.45 g/cm^3. This result confirms the fact that the density of regolith layer is almost the same over the lunar nearside.

Conclusion. Thus, it was shown that the correlation between crater parameters D_L and regolith thickness h is statistically significant for densities equal or higher than 1.9 g/cm^3. The regolith densities for lunar mare and highland are very close. The most acceptable range of regolith layer density is from 2.3 to 2.6 g/cm^3.

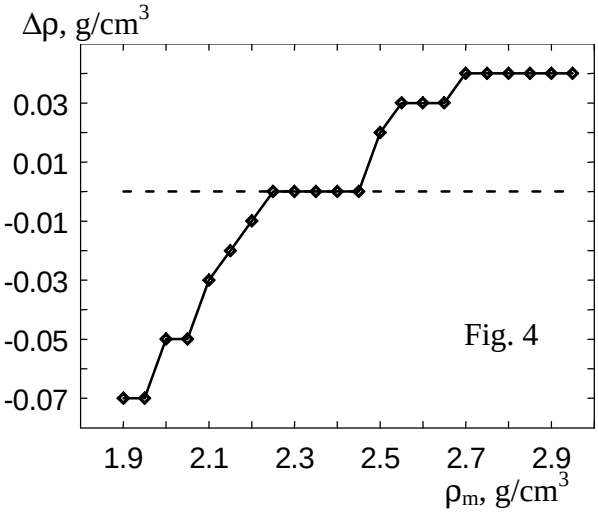


Fig. 4

References: [1] Soderblom L. and Lebofsky L. (1972) *JGR, 77*, 279-296. [2] Bondarenko N.V. and Shkuratov Yu.G. (1998) *Astron. Vestnik, 32*, 301-309. [3] Thompson T.W. (1987) *Earth, Moon, and Planets, 37*, 59-70. [4] Shkuratov Yu.G. et al. (1999) *Icarus*, in press. [5] Carrier III W.D. et al. (1991) In *Lunar source-book*, 475-594. [6] Shoemaker E.M. and Morris E. (1968) In *Surv. Proj. Fin. Rep. Pt 2*., 86-102.