GIANT COMETS IN INNER SOLAR SYSTEM? **V.V.Shevchenko, Sternberg State Astronomical Institute, Moscow University, Moscow 119899, Russia, e-mail: shev@sai.msu.su**

Studies of albedo anomalies - swirls on the lunar surface that look like diffuse structures, shown that the formations may be considered to be imprints of relatively recent cometary impacts. It was concluded that the dense streams of gas and dust from inner comet coma imprinted the thin friable surface layer to create swirls. Characteristics of the swirl regions and its positions on the lunar surface correspond to model of frequent giant "new" comet impacts about 10 myr ago. .. Measurements of swirl fragments and analysis of the data permitted to calculate sizes and contact velocities of these comet bodies. An average comet nucleus size is equal about 100-200 km. The most of comets had contact velocities about 50 km/s.

The nature of cometary impact imprints was discussed in detail and it was derived a tentative estimate of their ages using Reiner-γ diffuse formation as an example [1-5]. The analysis of the entire system of diffuse structures observed on the Moon provides additional information on the nature and origin of these formations, which have a direct relationship to some global processes going on in the Solar system [6-7]. It was shown that origin of the swirls can be caused by slight pressing friable surface layer with thickness of 1.0-1.5 cm. The bearing strength of the thick layer is about 0.3-0.7 N/cm^2 (Surveyor and Lunokhod data). Photographs of Apollo 15 landing site shown difference in surface albedo before and after the landing. It was speculated that the bright halo surrounding the landing site was a photometric effect caused by compaction of the thick layer of soil under influence of the dynamic pressure of the descent-engine exhaust gases [8]. Calculations indicated that such pressures approached ~0.7 N/cm^2 level. It was sufficient to destroy the initial friable structure of the photometric layer. This process may be considered as analogy of the forming swirls by contact of the gas/dust dense streams from inner comet coma with lunar surface layer.

Density distribution in homogeneous comet coma is determined by the following well known formula: $\rho = e^{-r/vt}\,(Q/4\pi v r^2)$, where $e^{-r/vt} = 1$ for H_2O molecules on the distance 1 A.U., expansion velocity $v = 3\cdot 10^4$ cm/s (DUCMA-VEGA data [9]), Q is gas production rate, r is distance from comet nucleus. If ρ is density of gas stream needed for creation of pressure on the lunar surface $p = 0.3$ N/cm^2 at contact velocity $V\,(\rho = 2p/V^2)$, then: $r = \{Q(R)/4{\cdot}10^5\,\rho(V)\}^{1/2}$, where R is radius of comet nucleus, $Q(R) = Q_S{\cdot}S_R$ is full production rate, Q_S is production rate for unit of area, S_R is general area of comet nucleus surface. For gas/dust streams in inner coma value of Q_S may be approaching $4.5{\cdot}10^{-5}$ g/cm^{2}s level (VEGA/GOTTO data). Measurements of swirl fragments and using relationships mentioned above permit to calculate sizes and contact velocities of the hypothetical comet bodies. Figure 1 (a, b) shows swirl region in Mare Ingenii as example (Lunar Orbiter images). Schematic map of the swirl fragment distribution for the region is given in Figure 2. The size and contact velocity of the impactor was calculated using model of tangential comet flight (Figure 3). Values of λ and L were measured on the swirl region image. Estimation of the hypothetical comet sizes were obtained from the following relationships: $r = R_c(1 - \cos\lambda)$ and $R = (L^2 + r^2)/2r$, where R_c is lunar radius.

Swirl region	Nucleus radius, km	Contact velocity, km/s	Swirl region	Nucleus radius, km	Contact velocity, km/s
Mare Marginis	122	54	Mare Ingenii	98	40
Mare Marginis (a)	46	52	Walker	56	53

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Estimations of the comet sizes and contact velocities for swirl region in Mare Ingenii and for others swirl regions are presented in Table.

Acknowledgments. This work was supported by the American Astronomical Society. The author thanks International Electronics and Engineering (San Jose, CA, USA) and UNI Inc. (Moscow, Russia) for supporting this work by provision with computer technique.

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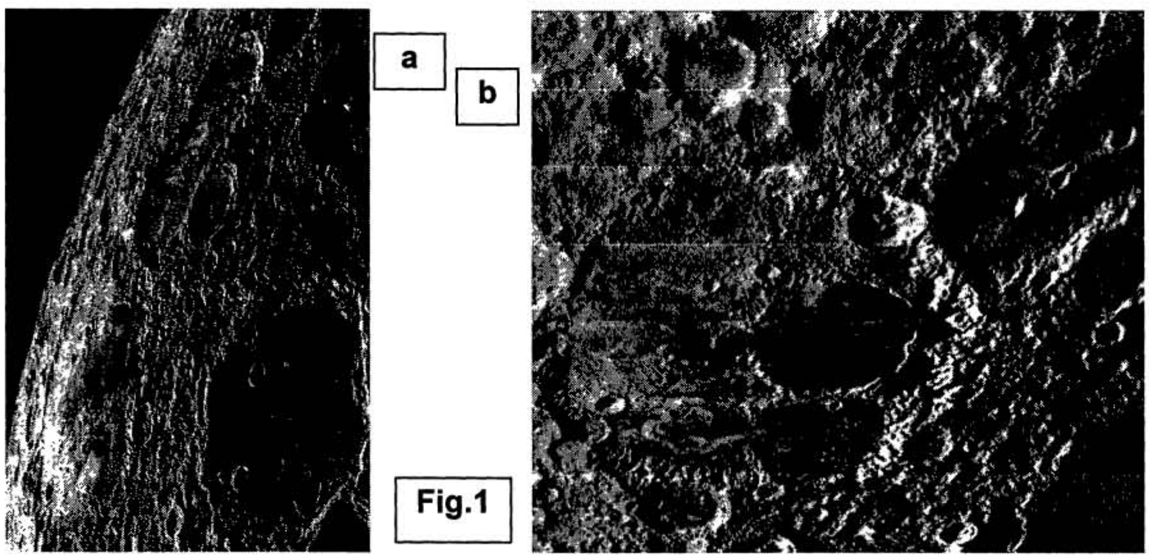

Fig.1

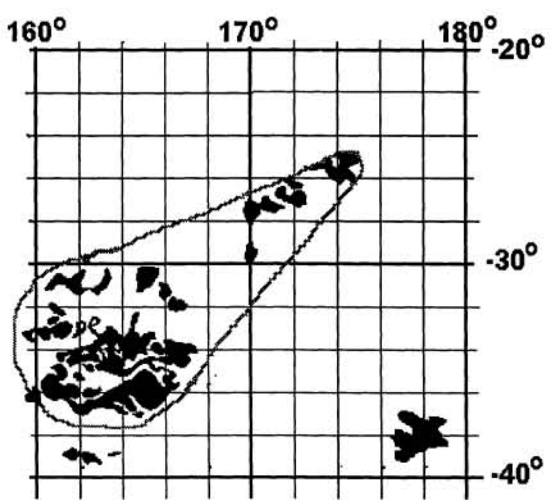

Fig.2

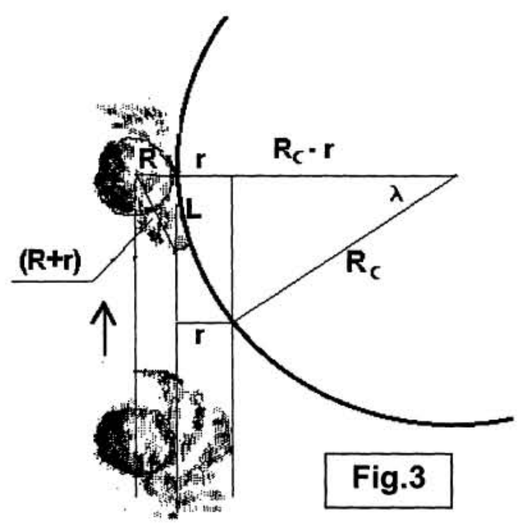

Fig.3