REMOTE METHOD OF IDENTIFICATION OF THE EJECTA LUNAR TERRAINS AND THEIR COMPOSITION FITURES. V.V. Shevchenko[1, 2], P. Pinet[2], S. Chevrel[2], S.G. Pugacheva[1], Y. Daydou[2]. [1] Sternberg State Astronomical Institute, Moscow University, 13 Universitetsky pr., 119992 Moscow, Russia; [2] UMR 5562/CNES/Observatory Midi-Pyrenees, Toulouse University, 14 avenue E. Belin, 31400 Toulouse, France. shev@sai.msu.ru

Introduction. We proposed that information retrieved from the local surface photometric behavior of the Moon could be used for guiding the remote sensing analyses of specific geological targets. It was shown that difference between the modeled and observed phase function for phase angle in the range of 18° is sensitive to the degree of surface roughness at the meter scale [1].

Photometric Data and the Debris Size-frequency Distribution. The average integrated lunar indicatrix [2] was used as a background photometric model. The Saari and Shorthill catalogue [3] data were used as observed local phase functions. The value of the difference of intensities mentioned above may be used as a photometric parameter Δ***I*** of the local surface roughness. The size-frequency distribution of the resolvable fragments on the lunar surface at the spacecraft landing sites was used to estimate the influence of the number of particles per unit area on the meaning of the photometric information. The greatest number of large fragments was observed at the Surveyor VII site. This area is pla -

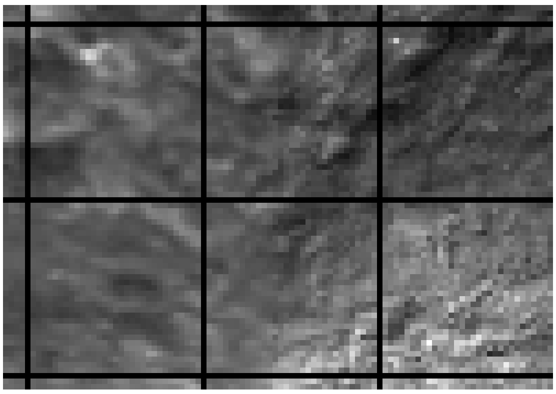

Figure 1. The area is located to the North from crater wall of Tycho. Surveyor VII landing site is placed in the center of the image (Clementine series).

ced to the North from crater Tycho (Fig.1). The type of the visible relief conjectures the existence of ejecta terrain. According Surveyor VII observation data the value of the cumulative

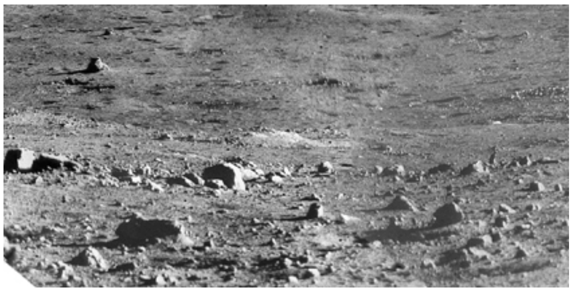

Figure 2. Mosaic of narrow-angle Surveyor VII pictures (fragment) [5].

number of particles N per 10^4 m^2 is about 22 of blocks < 4 m (Fig. 2). Comparison of the observed phase function of the Surveyor VII landing site and the average integrated lunar indicatrix shows a high value of the difference of intensities which is using as a photometric parameter Δ***I*** (Fig. 3).

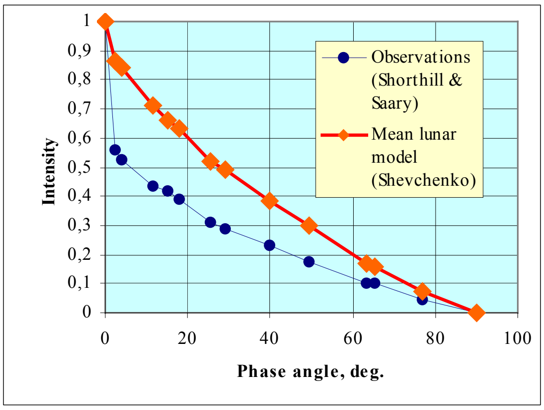

Figure 3. Phase function of the Surveyor VII landing site.

Photometric parameter dependence on the fragmental debris size-frequency was examined in terms of statistical data for a number of landing sites (Surveyor I, III, V, VI, VII, Lunokhod 1 and 2, Apollo 11, 12 and 15), and an area in Sinus Media (Lunar Orbiter II high resolution pictures) [4 – 10]. The data were extrapolated to block size estimates in the range of 4 m. A good correlation (0.815) between the local size-frequency distribution of fragments and the photometric parameter of roughness is observed (Fig. 4).

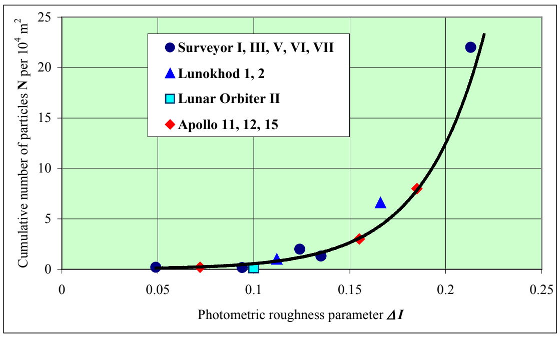

Figure 4. Comparison of the local cumulative number of particles N per 104 m2 and photometric roughness parameter ***ΔI***.

The Local Composition Features. In a preliminary investigation, we have compared the Lunar Prospector thorium contents for some regions of the lunar near side [11] with surface roughness estimated by means of the local photometric function. In the areas under study, the surface roughness photometric parameter (which can vary between 0 and 1) varies from 0.05 (smooth mare surface) to 0.25 (crater Tycho and its ejecta). Interestingly, a good anticorrelation (-0.985) is observed between the local thorium content and the photometric roughness parameter, indicating a possible association of Th-rich materials with the structure of the regolith disturbed by the emplacement of ejecta materials, which could indicate the surface distribution of KREEP materials. Figure 5 represents the diagram of relationship between photometric roughness parameter and local thorium content in different lunar regions. The line shows a mean polynomial

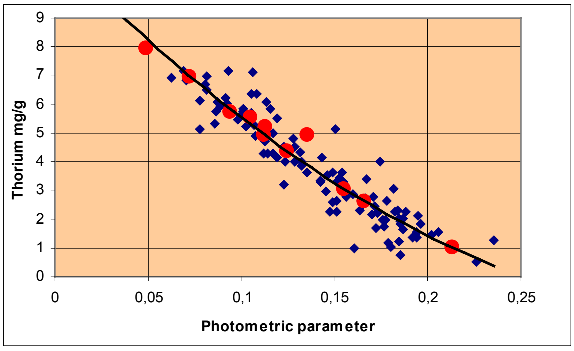

Fig. 5. Blue spots show thorium content and photometric parameters values for selected regions in Mare Tranquilitatis and in Tycho areas [11]. Red spots correspond to the values of the spacecraft landing sites and to an area in Sinus Medii (see more information in text above).

trend. The dots represent areas of a number of landing sites (Surveyor I, III, V, VI, VII, Lunokhod 1 and 2, Apollo 11, 12 and 15), and an area in Sinus Media (Lunar Orbiter II high resolution pictures). If the correlation between the local thorium content and the photometric roughness parameter reveals a possible association of Th-rich materials with the structure of the regolith, one may retrieve from the examination of ejecta an indirect information bearing on the thorium local distribution.

Conclusions and Future Work. According to these results, there may be a possibility to investigate, within specific anomalous Th-rich regions identified by Lunar Prospector, the local distribution of KREEP material and to explore whether there are some systematics in its mode of emplacement, either originating from the lower crust by impact basin cratering or resulting from volcanic processes [12]. Dedicated targets such as the Apollo 14 site where a significant in situ variability in the thorium content is known to occur could be surveyed by AMIE / SMART-1 to train and validate the procedure. Then, on this basis, the spatial variability of the thorium abundance could be derived for different geologic contexts such as within the South-Pole Aitken basin, the Apennine bench formation, the Procellarum Kreep Terrane and at the Apollo 15 location.

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