CURRENT EVENTS ON THE MOON: LROC AND CHANG'E-2 DATA. Yangxiaoyi Lu, V.V. Shevchenko, Sternberg State Astronomical Institute, Lomonosov Moscow State University, Moscow, 119992, Russia (luyangxiaoyi@gmail.com, vladislav_shevch@mail.ru).

Introduction: We know from practices of geology that rock material slides along a plane of structural weakness such as a bedding plane. Although they are most common on steep slopes, they can even occur on slopes of 15o. We can see such slopes from 10o to 20o on the Moon. On the Earth millions of tons of rock may plunge down slope at speeds greater than 160 km per hour in what is often the most catastrophic form of mass wasting. On Mars, similar slope failures are possibly caused by erosion from "running" water. However, the lunar triggering mechanism of the down slope movement of the material remains unclear. It's needed to study many questions regarding the stability of natural lunar slopes else. Moreover, it's needed to note that resent studies show that new computer models simulating the creation of gullies on the surface of Mars suggest that they are in fact created by the flow of dry debris (i.e. landslides) and not by the flow of water [1].

Avalanche deposits in lunar crater: Slope movements of material in lunar craters are investigated based on remote spectral studies carried out on board the Clementine spacecraft, and data obtained during the large scale survey on board the LRO (Lunar Recon- naissance Orbit) and Change'e-2 spacecrafts. The morphological analysis of crater forms based on largescale images and spectral and spectropolarized assessments of the exposition age (or maturity) of the slope material has led to the conclusion that the formation process of observed outcrops probably is a modern feature. Thus, slope movements of surface materials can continue at the present time, regardless of the age of the crater studied. Many features of the sur- face structures occur where the wall is bowed outward and probably represent slump deposits where portions of the crater wall have collapsed intoothe crater. Soil innerfrictionangleisnotmorethan20 forupperlayer matter. Bulk density of the surface soil is about 1.5 g/cm3 in the case. The age of the observed lunar slope degradation is very young [2, 3]. The lower age limit of these structures is estimated at 40–80 years be means of morphological method.

Spectral analyses of the crater avalanche: Processes of the space weathering on the Moon affect the optical properties of an exposed lunar soil. The main spectral/optical effects of space weathering are a reduc- tion of reflectance, attenuation of the 1-μm ferrous absorption band, and a red-sloped continuum creation. In work [4] it was proposed to estimate the maturity of lunar soils from Clementine UVVIS data using a meth- od which decorrelates the effects of variations in Fe2+ concentration from the effects of soil maturity. The local OMAT estimates points out at the occurrence of slope instability processes. Modeled in this way, values of the spectral reflectance yield a value of the optical maturity index OMAT = 0.73, the value of of the spec- tropolarization maturity index Isp = 3.74, and, accord- ingly, the model exposition age of the fresh surface outcrops of T ~ 80 years. Fig. 1 shows two fragments of crater Burg inner wall slope. The left fragment is part of the image number M113778346L/R (http://wms.lroc.asu.edu/lroc), the right fragment is part of image from Chang'e 2 (http://moon.bao.ac.cn). The last image was obtained by China's Chang'e 2 lunar probe on 23 October 2010 (Credit: China Lunar Explo- ration Program). The resolution of the image is near 7 m.

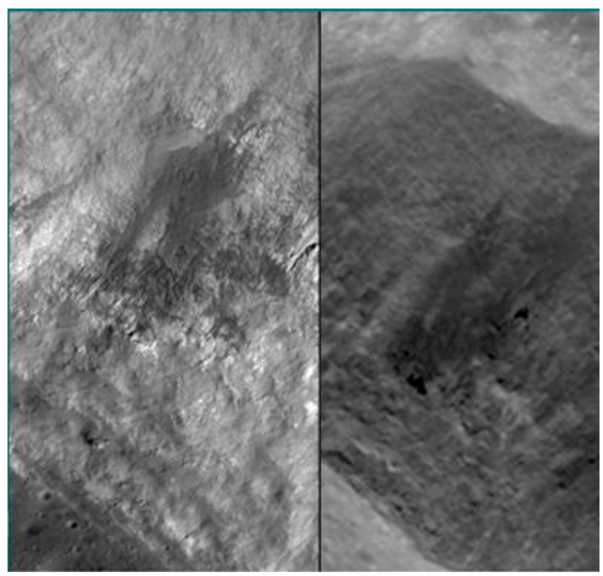

Fig. 1

The presence of very young dark details and immature soils on the inner wall slopes of the crater Burg suggests recent intensive slope processes. The most immature soils covered inner walls of this crater demonstrate that the origin age may be equal to the exposure age of the surface layer on inner wall. Calculated exposure age of the dark feature shows that it be as less as 10 years or less. It's possible the Lucey's method [4] is not correct in case of very immature soil however we can propose that observed events are results of current processes.

Iron content in the slope avalanche: In the study of fresh outcrops in number of lunar craters, an important feature is the iron content (or FeO content) in the sur- face material. From spectral measuring it follows that with decreasing maturity of the cover material the iron content increases to 20% and more. Since we are con- sidering the material of underlying layers, we can con- clude that the increase in the iron content is due to the properties of the subsurface material involved in slope processes. In general, the effect of the iron content on the reflectivity, as a major component of the chromo- phore, is characteristic of the lunar rocks. On the scale of the visible hemisphere a close correlation between the iron content and optical properties of the surface material was studied in detail in work [5], where land- ing sites of space probes and manned spacecraft were used as test areas. These results were further developed and confirmed in the work [6], where it was shown with high precision that ironenriched pyroxenes are the most optically active components of the lunar soil. The general conclusion from the comparison of the data is an abnormally high content of iron in the slope features as compared to the background surface. A marked in- crease in the iron content was found in the cases where shifting of the slope material from deeper subsurface layers took place. The clearest example is dark area in the crater Bürg (Fig. 1). The beginning of the material flow with a low albedo refers to a depth of about 400 m. According to spectral measuring this area is charac- terized by an abnormally high content of FeO reaching almost 20 weight %. The dark rocks on the North wall of the crater Bürg are located at approximately the same depth (420m). The content of FeO in the outcrop is approximately 19-20 weight %. Fig. 2 shows subsur- face layers of the dark rock with high content of iron on a crater inner wall (image number M124797072, http://wms.lroc.asu.edu/lroc). The origin of many of these flows is at a depth of ~ 600 m, where, apparently, lies the material with an average iron content of 17 - 19%, as determined by remote spectral data. The morphological characteristics of the surface, which can be seen in the M113778346L/R high resolution image, are mainly close to a region of the same type, shown in Fig. 1. There are almost no pronounced flows of the flowing soil, and there are impact craters with diameters from 3 to 5 m. Thus, as a result of the analysis, it was found that there is a general trend of increasing Fe content with depth of occurrence of layers of lunar surface material. But individual deviations from this general provision point to a more complex process of formation of the upper layers of the lunar lithosphere and require furher detailed study. The total area of these structures is small, and they seem to have no significant effect on the determination of the average values of the optical parameter of maturity and the iron content in the covering material. However, to fully understand the mechanisms of slope movements of lunar soils and their characteristics, these structures require further investigation with a corresponding resolution of the spectral data.

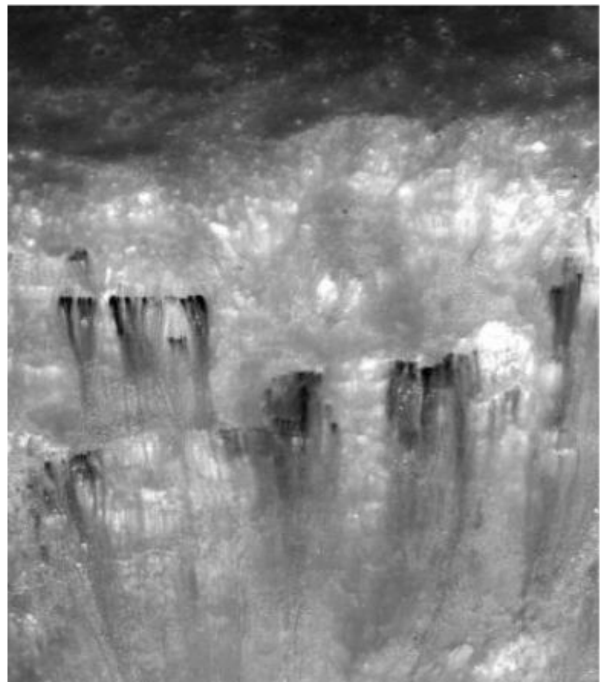

Fig. 2

Conclusions: The scientific use of large scale surveys of the lunar surface, with the assistance of remote methods of planetary astrophysics, has made it possible to to explored processes of contemporary changes on the lunar surface. The analysis of the nature of current slope movements of fine material in lunar craters opens a new area of research that affects several aspects of the phenomena observed in the lunar environment, i.e., from the optical parameters of the covering material to the mechanical properties of soil, iron content and the influence of exogenous processes on them.

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