DRY DEBRIS FLOW ON THE MOON: CHANG'E – 2 DATA. Lu Yangxiaoyi, V.V. Shevchenko, Sternberg State Astronomical Institute, Moscow University, Moscow, 119992, Russia (luyangxiaoyi@gmail.com)

Introduction: A few time ago Shevchenko et al. [1] discovered of evidence of avalanching and of other downslope movement of material that is clearly visible on the inner walls of the crater Reiner. In general, freshly exposed lunar material is brighter than undisturbed materials nearby. The brightness of the avalanche scars is an indication of their freshness. The image shows numerous bright avalanche deposits on the steep crater walls, apparently originating at outcrop ledges near the top of the wall. The maturity index values of the different soil areas ranging from box 2 to box 4 correspond to exposure age from 6 to 0.5 million years [2]. Similar features were discovered on the image of crater Daniell recently.

Crater Daniell: Fig.1 shows crater Daniell. Diameter of the crater is 29 km. Crater Daniell is located in the southern half of Lacus Somniorum, at 31.6E, 35.18N. The diameter of the crater is 29 kilometers.

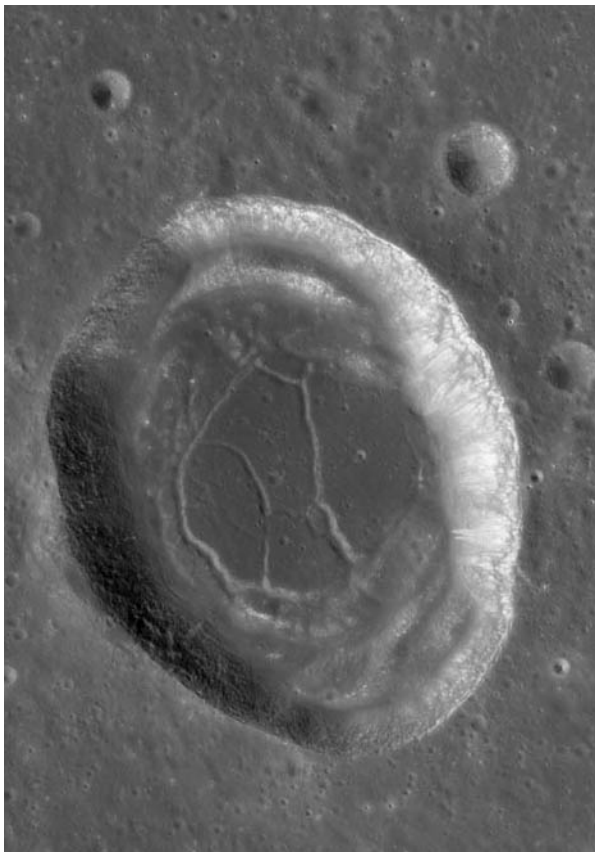

Fig. 1

This image was obtained by China's Chang'e 2 lunar probe on 23 October 2010 (Credit: China Lunar Exploration Program [3]). The image was taken from the altitude of 100 kilometers above of the lunar surface. The resolution of the image is near 7 m. It is similar the cracks on the crater floor are signs of ancient lunar impact volcanism.

Fig. 2

Fig. 2 shows west-east profile of the crater Daniell in which vertical scale is the same as horizontal scale. Topographic data are taken from lunar map [4]. General slope of the western part of the inner walls is about 20°. There is a terrace on the eastern wall slope. Slope of the eastern crater inner wall is in range 17° –18°. The image shows numerous bright avalanche deposits on the steep crater walls, apparently originating at outcrop ledges near the top of the wall. On the eastern wall, most avalanches stop in a moat at the base of the wall (near terraces). On the western wall, avalanches extend out onto the irregular, inward- sloping floor.

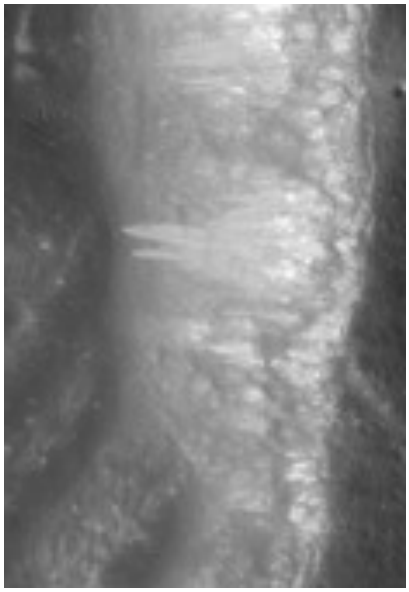

Fig.3

Fig. 3 shows typical form of most light slope material that coincides with most immature soil (very bright matter). This detail is indicated by pointer.

Fig. 4 shows the same features with resolution about 1.63 m. It's a fragment of image taken by NASA LRO lunar probe on 4 September 2009 from the altitude of 164.88 km above of the lunar surface (image LROC M106676014R [5])

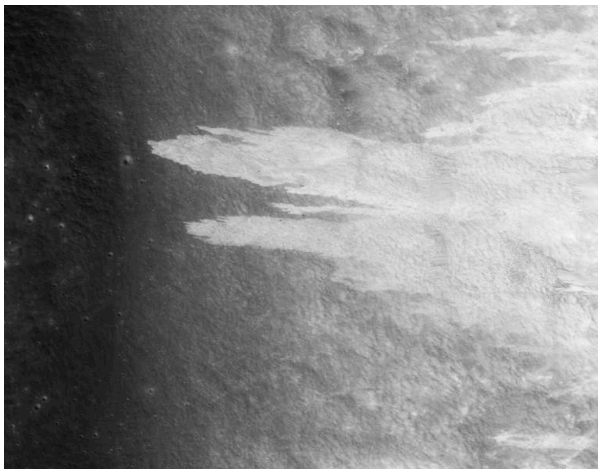

Fig. 4

Discussion: 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 15°. We can see such slopes from 10° to 20° 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 [6].

Now we resume one's lunar story. Debris avalanches are moving masses of rock and soil that occur when the border of the crater wall collapses and slides downslope. As the moving debris rushes down a crater, it incorporates rocks and soils. Debris avalanches may travel several kilometers before coming to rest.

Double debris flow shown in Fig. 3 – 4 has length from crater wall collapse to the debris stream about 3 – 4 km.

Other type of the slope avalanche deposits in crater Daniell (on east-southern crater wall) is shown in Fig. 5 (image LROC M126724943L [5]).

Fig. 5

In the case we can see large fresh blocks as evidence of recent catastrophic form of mass slope movement.

Conclusions: The presence of very young details and immature soils on the inner wall slopes of the crater Daniell suggests recent intensive slope processes. The most immature soils cover inner walls of young small craters of which the origin age may be equal to the exposure age of the surface layer on their inner walls and be as less as 1 Myr or less.

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References: [1] Shevchenko V.V. et al. (2007), *LPS XXXVIII*, Abstract # 1066. [2] Shevchenko V.V. et al. (2010), *LPS XLII,* Abstract #1161 (this issue). [3] http://moon.bao.ac.cn/. [4] Lunar chart, 1:1000000 (1967), NASA-ACIC, LAC 26. [5] LROC Image Browser. [6] Banks M. E. et al. (2008) *JGR, 113,* Issue E12, CiteID E12015.