Introducción: El deslizamiento de Tsiolkovskiy fue creado cuando la parte occidental de la cuenca de Tsiolkovskiy colapsó, deslizándose hacia el suelo de la cuenca de Fermi [1-4]. Este deslizamiento es el único deslizamiento de largo trecho encontrado en un cuerpo sin aire (completamente dominado por fricción). Consecuentemente, representa un miembro extremo de los deslizamientos de largo trecho, y su estudio ofrece la oportunidad de obtener insight into the mechanics and conditions que controlan la colocación de tales características.

Morfológia: La cuenca de Tsiolkovskiy colapsó en dos lugares dejando un píñon en el borde, y produciendo dos deslizamientos adyacentes (Fig. 1). Un tramo entre los deslizamientos se extiende desde el píñon en el borde hacia afuera. El deslizamiento norte (Slide A) es de forma de fan, entaladado radial, y tiene una berm de bajo y estrecho terminal [1-4]. Los trazos son especialmente similares a los del deslizamiento de Sherman [5]. El deslizamiento sur (Slide B) tiene dos partes: una parte norte similar al Slide A, pero con un desarrollo bien desarrollado terminal ridge, y una parte sur irregular, mohosos, trazado libre sur. Sus diferencias en morfológia (e.g., presencia o ausencia de líneas) pueden ser debido a diferencias en rugosidad de la superficie inicial [6] donde la parte sur del Slide B probablemente viajó por mohosos ejes de Tsiolkovskiy mientras Slide A y la parte sur del Slide B se colocaron en las llanuras de Fermi crater. Normalmente los terrenos cratados deben ser cubiertos por ejes porque de su proximidad a Tsiolkovskiy pero, como se nota por [7], Tsiolkovskiy ejes son asimétricos con espesor del material de depósito en la parte sur de Slide A.

Morfológia: Slide A is ~65 km long [L], its volume [V] is ~1325 km^3, a vertical drop from its original position of ~4.5 km [H], an L/H = 14.4, and a coefficient of friction [H/L] of 0.07. For slide B: L = ~73 km, V = ~1659 km^3, H = ~4.5 km, L/H = ~16.2 and H/L = ~0.06. Fig. 2 plots the L/H ratio and V, and Fig. 3 plots H/L ratio and V for Slide A and B, and terrestrial and Mars long run-out landslides. These plots show that the mobility and coefficient of friction (efficiency) of Slides A and B are comparable to some long run-out landslides on Mars in Valles Marineris (VM), but less efficient than those on Earth, which has implications for the landslides in VM [8].

Superposed Impact Craters: Previous investigators suggested that there is a high density of small fresh craters on the slide, and that these craters may be caused by drainage of fine-grained ejecta into voids [2], degassing [1], or differences in material properties such as an absence of a regolith on the landslide [9]. Crater counts, using NAC images (Fig.4), show that the density of craters on the slide is no greater than on any surrounding unit hence, the earlier perception of a high density of small craters on the slides compared with the surrounding units is incorrect. In addition, LROC NAC images clearly show that most craters on the slides have raised rims, hence not rimless drainage craters. Also, crater chains are not found along the grooves, hence a degassing origin is unlikely.

Conclusión: The Tsiolkovskiy landslide is actually two adjacent slides formed nearly
simultaneously (at about ~ 3.6 Ga.), likely soon after Tsiolkovsky crater. Their morphologic differences are probably due to differences in the terrain they traversed. They were emplaced dry, but have similar efficiencies as slides in VM. The density of small craters on the slides appears greater than it is, possibly due to a lower rate of morphologic maturing. This work supported under a NASA GSFC/ASU LROC contract.


Fig. 1. Sketch map of the Tsiolkovsky landslides area. Base map is color coded WAC-based shaded relief image with topography colored (browns highest, blues lowest). White boxes are craters count sample areas. Fig. 2. Relationship between the landslide volume (V) and mobility (L/H) [10], and Fig.3 is the relationship between the coefficient of friction of the slides (H/L) [11], and volume for the Tsiolkovsky slides, extraterrestrial, non-volcanic, volcanic and submarine events. Fig.4. Crater count data for slides A & B (green) (model age = 3.6 Ga), cratered plains in Fermi (red squares), ejecta at the base of Tsiolkovsky’s southwest rim (red triangles), and Tsiolkovsky’s northwest rim (red circles) (model age = ~ 4.05 Ga). Note the similarity in density of all craters < 350 m dia.