Mobility of Landslides on Asteroid Vesta.

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Introduction: The Dawn Mission orbited Asteroid (4) Vesta between August 2011 and September 2012 [1] and revealed many mass-wasting features [2]. Several craters and slopes show landslides that can be analyzed using Heims ratio H/L_{max} as a proxy for the coefficient of friction and the mobility of the mass motion [3].

Data: We used Dawn Framing Camera data [4] in LAMO (Low Altitude Mapping Orbit, 20 m/pixel) and HAMO (High Altitude Mapping Orbit, 70 m/pixel) resolution. Through repeated imaging of the same area with different viewing geometries, the stereo data was converted into a three-dimensional Digital Terrain Model (DTM) of 100 m/pixel spatial resolution and ~5 m vertical accurancy on the basis of a 285 km by 229 km spheroid [5].

Aim: In this work, we investigate mass movements and landslides with lobate deposits of debris and talus material. Our aim is to understand and investigate the mobility of landslides on Vesta and to complement existing data-sets of landslide run-out lengths, fall height and volume. Vesta is a dry and differentiated object with a thick layer of regolith and no atmosphere. This environment provides excellent conditions to investigate the volume dependence of run-out length explained by models such as acoustic fluidization [3]. Atmospheric interactions and lubrification by volatiles, which play a role when investigating landslides on Earth, Mars [6] or icy satellites [7], will not affect the motion if landslides on Vesta. Moreover, the parameters describing the landslides' morphology will provide new insight into the regolith properties of Vesta.

Results and Discussion: The density of identified landslides within craters and on slopes is higher in the south and the equatorial region. This is most likely because the Rheasilvia impact basin in Vesta's southern hemisphere introduces steep gravitational slopes [8] on which landslides easily develop when triggered by, for example, seismic shaking due to impact cratering [9]. Additionally, the northern hemisphere of Vesta was partly shadowed during the LAMO phase of the mission and thus the resolution of the northern data is partly from the lower resolution HAMO phase or not covered. Many craters have shadows within them and it was often challenging to identify landslides in the northern hemisphere resulting in a likely observational bias. Nevertheless, the data collected in the southern hemisphere and the equatorial region of Vesta are satisfactory and sufficient for our investigation.

In order to interpret the mobility of landslides on Vesta, we determined several H/L_{max} ratios. For this, we analyzed the maximum run-out L_{max} and the initial height H of these slides. While most of the obtained H/L_{max} ratios show a typical decrease with increasing run-out length, landslides with a run-out length smaller than 7 km show the opposite trend: The H/L_{max} ratio increases with L_{max}. The landslides contributing to the latter trend are exclusively intra-crater landslides, whereas the trend of decreasing H/L_{max} with increasing L_{max} is represented by both, intra-crater landslides and landslides on slopes. It is likely that the volume of smaller intra-crater landslides is not sufficient to reduce the internal friction with acoustic fluidization.

At the meeting we will present a detailed data-set of parameters describing landslides on Vesta including landslide run-out lengths, fall heights, volumes, the gravity environment and the landslide mobility.sss

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