LANDSLIDES AND THEIR MOBILITY ON ASTEROID (4) 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 Heim's ratio of the fall height H and the run-out length L (H/L) as a proxy for the coefficient of friction and the mobility of the mass motion [3].

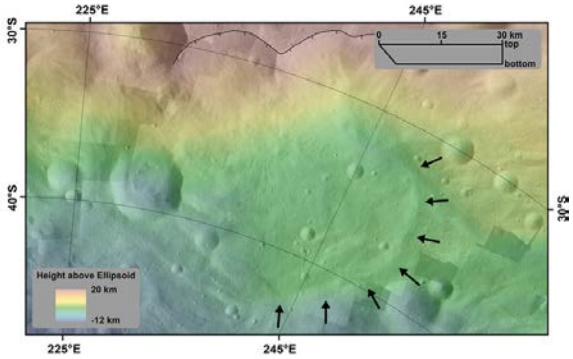

Figure 1. Long run-out landslide on asteroid Vesta. The run-out length is marked by the arrows and the fall height by the scarp line. Image from Otto et al. (2013) [2].

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 and a 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] to identify landslides on Vesta and determine their morphologic paramters.

Aim: We investigate 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.

Results and Discussion: Figure 1 shows an example of a long-runout landslide on Vesta from Otto et al. (2013) [2]. In order to interpret the mobility of landslides on Vesta, we analyzed the run-out length L and the initial fall height H of 22 landslides and determined their H/L ratios (Figure 2). Most of these landslides were found in the southern hemisphere of Vesta due to the prominent topography caused by the Rheasilvia impact basin [2] and the better illumination conditions. While the obtained H/L ratios of landslides with small volumes are constant at ~0.7, landslides with volumes exceeding ~9 km³ show a decreasing trend with increasing volume. The increase in landslide mobility with increasing volume has previously been explained by acoustic fluidization by Collins and Melosh (2003) [3]. The critical landslide volume at which smaller landslides tend to follow a constant H/L trend and larger landslides show a decresing H/L ratio with increasing volume is approximately four and three times larger compared to landslides on Earth and Mars, respectively.

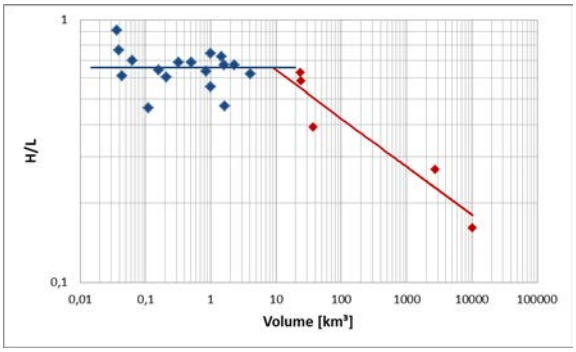

Figure 2. The ratio of fall height and run-out length of landslides on Vesta in dependence of the landslide volume. The blue and red points show the data for smaller and long run-out landslides, respectively. The lines fit the data points. Note the double logarithmic scale.

References: [1] Russell, C.T. et al. 2013. *MPS* Science 48(11):2076-2089. [2] Otto, K.A. et al. 2013. *JGR* 118(11), 1-16. [3] Collins, G.S. and Melosh, H.J. 2003. *JGR* 108 (B10), 2473. [4] Sierks, H. et al. 2011. *SSR* 163 (1-4), 263-327. [5] Preusker, F. et al. 2012. 7th EPSC 2012, #EPSC2012-428-1.