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Potential Identification of Sublimation-Driven Downslope Mass Movements on Mercury

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1. Introduction

Mass movement has been recognised on many solar system bodies. Evidence of mass movement on Mercury has previously been limited to a single documented example, found in the pyroclastic vent NE of Rachmaninoff crater (Nathir Facula). Here we present the identification of a further three examples.

2. Identified Examples

2.1 Mass movement in Nathair Facula Vent

Attention was drawn to the slope features in the Nathair Facula vent (NE of Rachmaninoff crater) (Fig. 1) on the MESSENGER web-site, but so far as we are aware there has been no formal study. The features are downslope erosion-deposition systems with an alcove at the head, chute and a fan at the base. Feature heads appear to develop in a stratigraphic layer of brighter material (Fig. 1B). This brighter

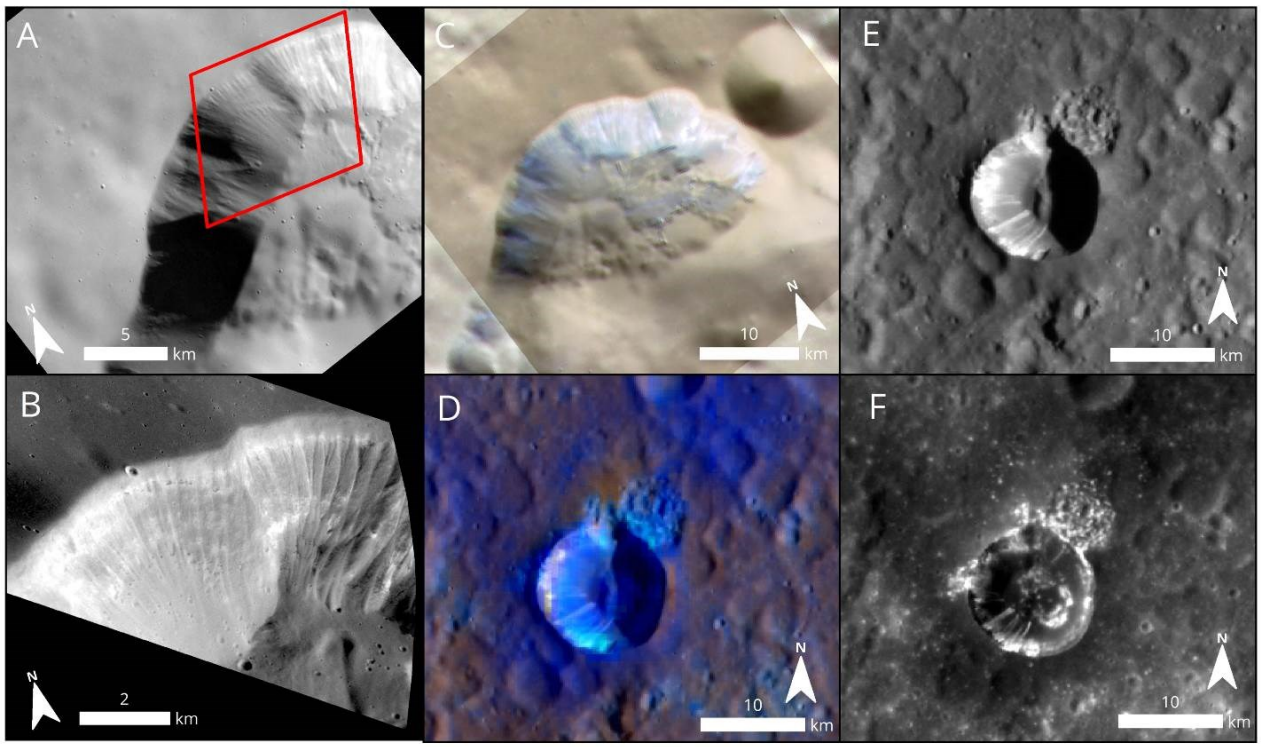

Fig. 1: A,B,C Gully-like slope features in vent NE of Rachmaninoff. A:Context image centered on 36°N, 63.8°E showing widespread slope features. Box shows location of B. (NAC: EN1003843866M) B: High resolution (6.4m/pixel) image showing source at bright layer (NAC: EN1028933034M) C: Enhanced color. D, E, F. Newly discovered slope features at 8°S, 55°E. D, enhanced color; E, high incidence angle (NAC: EN0252295266M) F, low incidence angle. Note bright, possibly hollow forming, material, high in crater wall (NAC: EN1028933034M).

material appears to be related to hollows [1].

2.2 Slope features in unnamed crater (≈285 km N of Nabokov)

The newly identified slope features are in a ≈12 km diameter simple impact crater. The crater is surrounded by low reflectance material and has an area of hollows on the NE crater rim. The slope features start just below the crater rim, in a bright stratigraphic layer. This may be similar to the hollow forming layer in Nathir Facula vent.

2.3 Possible slope features in Berkel crater and peak ring element in Rustaveli crater.

We have identified a third possible set of downslope oriented high albedo slope features in Berkel crater. This is a complex crater and the features of interest are located on the rim terraces. These features also appear to start in a bright layer below the crater rim. This is the least confident identification.

We are also investigating a possible slope feature on a peak ring element in Rustaveli crater. This is visible only in low altitude imagery.

3. Current work

We are examining other areas with steep slopes and catalogued hollows, and are performing a global survey to identify any further examples. We will compare the topography of these features to erosion-deposition systems on the Moon [2, 3], Mars [4,5], and Vesta [6]. Currently our working hypothesis is that these downslope movements are triggered by sublimation.

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