DAWN OBSERVATIONS OF MARCIA CRATER, VESTA. B. W. Denevi[1], D. T. Blewett[1], F. Capaccioni[2], M. C. De Sanctis[2], W. B. Garry[3], J.-Y. Li[4], S. Marchi[5], T. J. McCoy[6], A. Nathues[7], N. E. Petro[8], C. A. Raymond[9], C. T. Russell[10], P. Schenk[11], J. E. C. Scully[10], J. M. Sunshine[4], D. A. Williams[12], R. A. Yingst[3], [1]Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA, [2]INAF, Istituto di Astrofisica e Planetologia Spaziali, Rome, Italy. [3]Planetary Science Institute, Tucson, AZ, USA, [4]University of Maryland, College Park, MD, USA, [5]NASA Lunar Science Institute, Boulder, CO, USA, [6]National Museum of Natural History, Smithsonian Institution, Washington, DC, USA, [7]Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany, [8]NASA Goddard Space Flight Center, Greenbelt, MD, USA, [9]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA, [10]University of California, Los Angeles, CA, USA, [11]Lunar and Planetary Institute, Houston, TX, USA, [12]Arizona State University, Tempe, AZ, USA.

Introduction: The Dawn spacecraft [1] is now in its low-altitude mapping orbit (LAMO, ~210 km altitude) around asteroid Vesta, acquiring Framing Camera (FC) images [2] at pixel scales of <20 m. These images reveal unusual morphologies within and surrounding Marcia, a ~70 km impact crater located at 10° N, 190° E. Here we present initial observations of geologic features associated with Marcia crater.

Data: Available LAMO images (~18 m/pixel) cover approximately half of the crater interior and only a portion of its ejecta. We supplement these high-resolution images with those collected during the high-altitude mapping orbit (HAMO, ~680 km) at pixel scales of 70 m. A digital terrain model (DTM) derived from HAMO images [3] provides topographic context and slope information.

Observations: Marcia is an irregularly shaped crater ~62 km across from east to west and ~77 km in the north-south direction (Fig. 1). Marcia superposes the 50-km Calpurnia crater to the northeast, which may have formed nearly contemporaneously [4]. In addition to the topographic low of Calpurnia, the regional topography slopes north to south, which likely affected the crater's overall shape. Slumping occurs most prominently within the southern and southwestern rim, with a slump terrace observed to the south.

Crater Walls. The walls of Marcia largely show the downslope movement of fragmental material typical of steep slopes, and expose relatively high-reflectance material. Along the southern portion of the crater wall, an area of relatively smooth, lower-reflectance material is observed. This material occupies a region of relatively low slopes (~6°) atop a slump terrace, and continues downslope to the northwest around the most prominent terrace. As the gradient steepens to ~12°, the deposit is marked by discontinuous linear channels ~300-450 m wide and lobate flow fronts are observed down gradient of the channels where the crater wall meets the relatively flat crater floor (Fig. 1, white arrows).

Crater Floor. Material with similar reflectance properties is observed on the crater floor and ranges from a smooth to dimpled texture. Depressions in the dimpled areas range in size from <30 m (not resolved at 18 m/pixel) to just over 1 km in diameter, and some have no obvious rim (e.g., Fig. 1, blue arrows). The smallest depressions are concentrated mainly around the perimeter of the crater floor and increase in diameter toward the center where they coalesce and overlap. Evidence for subsidence or drainage is seen around and within several depressions. The depressions generally show no preferred orientation, except for one small linear chain. Two of the largest depressions are surrounded by a smooth deposit with circumferential ripples (Fig. 1, black arrows). The largest depression (1 km) is nearly circular, while the other (600 m) is irregular in shape.

A flat-floored, irregularly shaped depression 5-6 km across occupies the central floor. This surrounds what appears to be an incipient central peak (Fig. 1, green arrow), a portion of which is more mesa- than peak-like, consisting of a flat plateau surrounded by steep sides. Boulders with dimensions >200 m are clustered to the north and west of this mesa; their origin is not readily apparent.

Crater Exterior. The Marcia impact event largely resurfaced the surrounding region within one crater radius. Smooth material blankets much of terrain and partially fills topographic lows (red arrows). Within this continuous ejecta unit, the morphologies of some craters are shallow and dimple-like, consistent with the presence of a hard-rock veneer of impact melt. Clusters of small craters are also observed.

Discussion: The morphology of the floor of Marcia crater is thus far unique to Vesta and is unlike features observed on other airless bodies. Features within the crater and ejecta suggest the presence of impact melt, and we are investigating what fraction is melt vs. granular material. One possible mechanism for the formation of the depressions on Marcia's floor is through low-velocity, self-secondary impacts. However some depressions lack a raised rim and secondary cratering does not provide a ready explanation for the observed size gradient of depressions (small at margins). Clusters of small craters in Marcia's ejecta blanket are most likely secondary craters; they do not show

the same size range and gradation of sizes as observed on the crater floor. This size gradient may correlate with the depth of a melt-rich or pulverized granular layer that occupies the floor, which would be expected to be thicker near the center and feather toward the walls. The general lack of linear chains of pits on the floor suggests the depressions did not form via collapse into subsurface fractures, though evidence for drainage or subsidence is observed in some areas.

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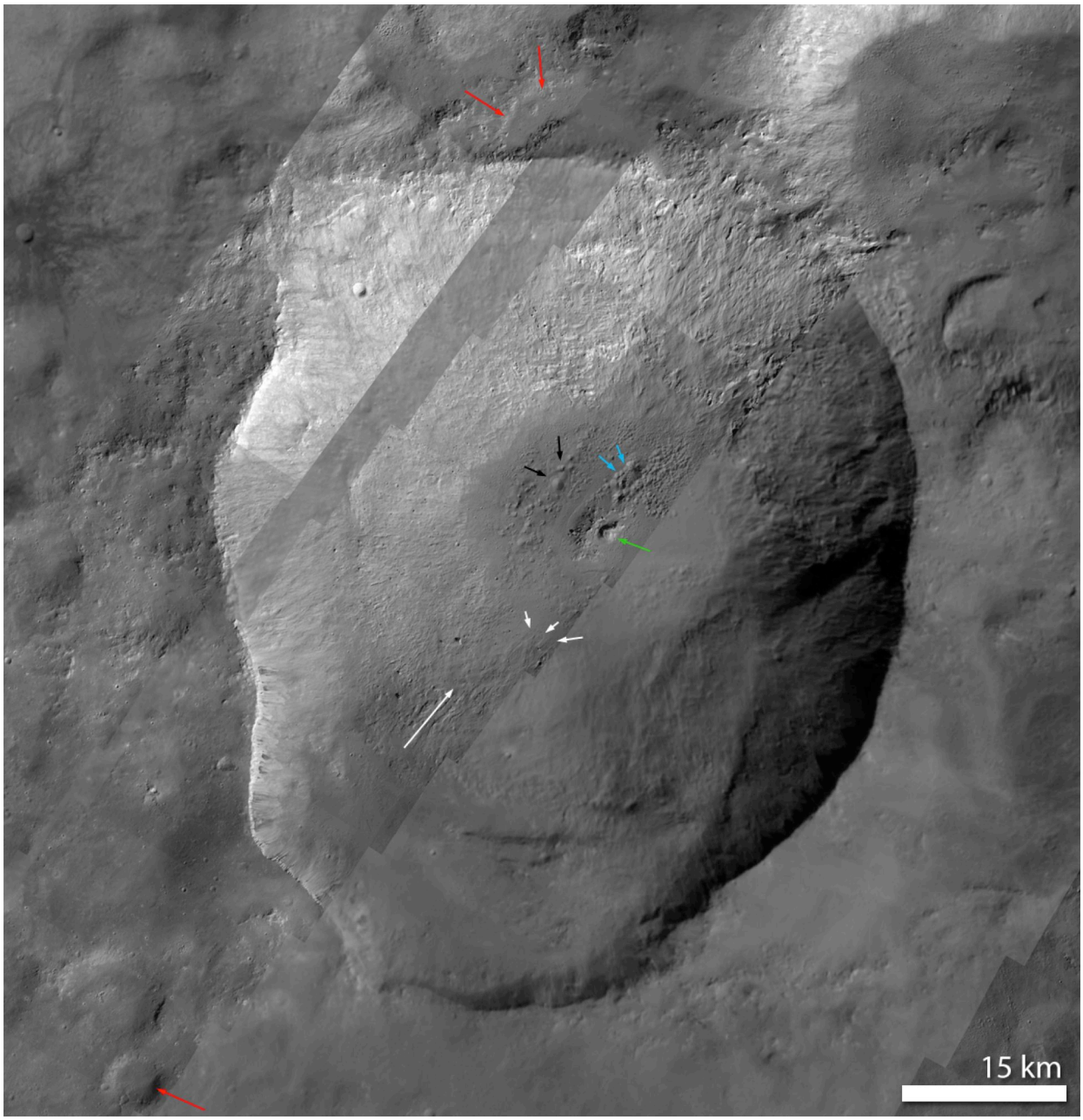

Fig. 1. FC mosaic of Marcia crater (10° N, 190° E). High-resolution LAMO images (18 m/pixel) are shown overlain on lower resolution (70 m/pixel) HAMO images. White arrows indicate regions of downslope movement of material on the wall through discontinuous channels, with flow lobes found down gradient. Black arrows indicate large depressions surrounded by smooth deposits with ripple-like edges. Blue arrows highlight selected depressions without rims. The green arrow indicates a possible incipient central peak. Red arrows show regions where smooth deposits partially fill topographic lows in the surrounding terrain.