MEASUREMENT OF SMALE-SCALE PITS IN THE CORINITO CRATER, MARS. V. J. Bray[1], L. L. Tornabene[1], A. S. McEwen[1], and S. S. Mattson[1]. [1]Lunar and Planetary Lab., University of Arizona, Tucson, AZ 85721, USA. vjbray@lpl.arizona.edu

Introduction: Central pit craters are observed most commonly on the Jovian satellites of Ganymede and Callisto, and on Mars (e.g. Fig. 1). Their association with ice-rich bodies has led to the hypothesis that central pit formation depends upon the presence of water ice [e.g. 1, 2, 3, 4]; possibly via drainage of impact melt water or the release of gas. However, a consensus on the exact mechanism of formation is yet to be reached.

HiRISE [5] imagery is providing the capability to analyze small-scale features of these enigmatic craters for the first time, revealing alluvial fans, viscous flow features and ponded regions of pitted material interpreted to be a mix of melt and fragmented rock – impact melt breccias (a.k.a suevite) [6, 7]. The small-scale pits are found on the crater floors, behind rim terraces and on the ejecta blankets of relatively fresh craters, and have also been noted in coalescing groups associated with the subsidence of local terrain [6, 7]. This characteristic may have implications for the central pit formation mechanism.

We are collecting measurement of the small-scale pit dimensions in the fresh Martian impact crater, Corinto, so that the possible relation of pit-concentration and local terrain subsidence of the crater floor can be quantified once a high-resolution topographic profile of the crater is obtained.

Method: Corinto is a 13.5 km diameter floor-pit crater, also identified as the largest of the fresh and well-preserved Martian rayed craters [8, 9]. Although located on the dust-rich flank of Elysium Mons (141E, 17N), the pitted morphology noted by [6, 7] is still prominent, allowing mapping and measurement of the individual pits. This crater was thus chosen for our initial analysis.

We used the HiRISE image PSP_003611_1970 to analyze the small pit morphology and outline the edges of individual pits using the Environment for Visualizing Images (ENVI) (Fig. 2B). Due to partial dust cover and the complex nature of pit coalescence, the boundaries between pits are often ill-defined, making the determination of separate pits highly subjective. The image was hard stretched so that the most well-defined pit edges could be identified as a Region of Interest (ROI) (Fig. 2B). The area and relative location of each ROI was then calculated. This enabled us to assess pit size with respect to distance from the crater center.

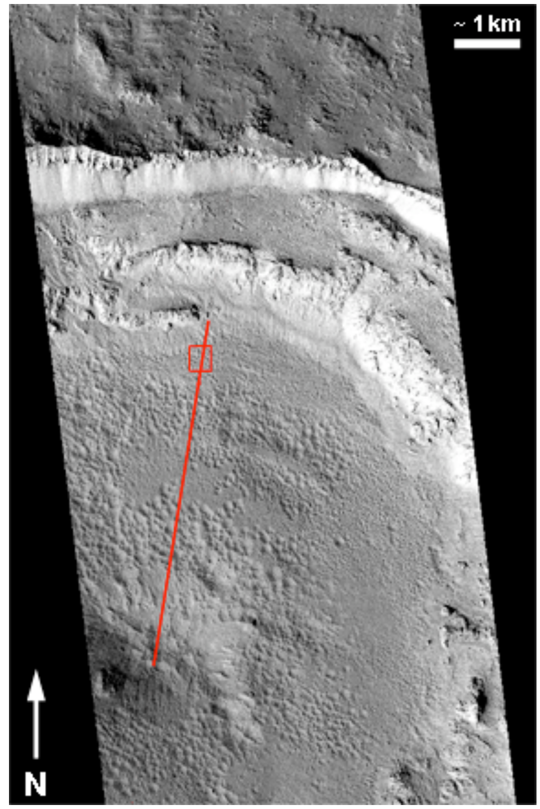

Fig. 1: HiRISE image PSP_003611_1970 of Corinto, a floor-pit crater at 141E, 17N. The pit is seen in the bottom left of the image and the crater rim at the top. The red line shows the approximate track along which pit areas were measured in this work. Close up of the area within the red box is shown in Fig. 2.

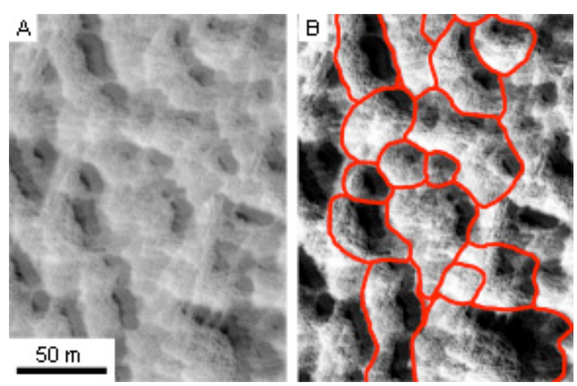

Fig. 2: Close up of the boxed area in Fig. 1. A) Original HiRISE image. B) Increased contrast image with pit edges marked in red.

Discussion: Although noted on the ejecta blankets and behind wall terraces, the largest and most numerous pits occur on the crater floor. The pits included in this study (to date) are all from Corinto's crater floor and range in area from 100 to 33000 m^2; they are commonly sub-circular, rimless and lack obvious surrounding ejecta, which indicates that a non-explosive origin is likely. It is possible that collapse pits may form due to the percolation of melt into the fragmented sub-crater rock mass, or the escape of post-impact gases, as previously suggested by [6, 7].

Fig. 3 shows that the largest pits occur at the crater center on the central pit floor and in the region surrounding the main central pit. This is an intuitive result if these pits are formed by collapse of the surface material into void space, as the higher post-impact temperatures at the crater center would facilitate the percolation of larger quantities of melt into the crater floor, or produce larger volumes of vented gas. Both options would produce larger pits at the crater center, with smaller pits on the terraces and near-rim ejecta being consistent with smaller ponds or melt bodies.

Coalescence of these possible collapse pits may contribute to the formation of Corinto's main central pit. However, more detailed investigation of the relation between pit concentration and crater floor subsidence is necessary to assess the validity of this suggestion. Although not obvious from the low resolution MOLA gridded digital elevation model (DEM) created from MOLA data, it is anticipated that a high resolution DEM of the region detailed in Fig. 3 may reveal additional topographic features within the 'crater floor' region; variation of pit size with elevation will then be assessed further.

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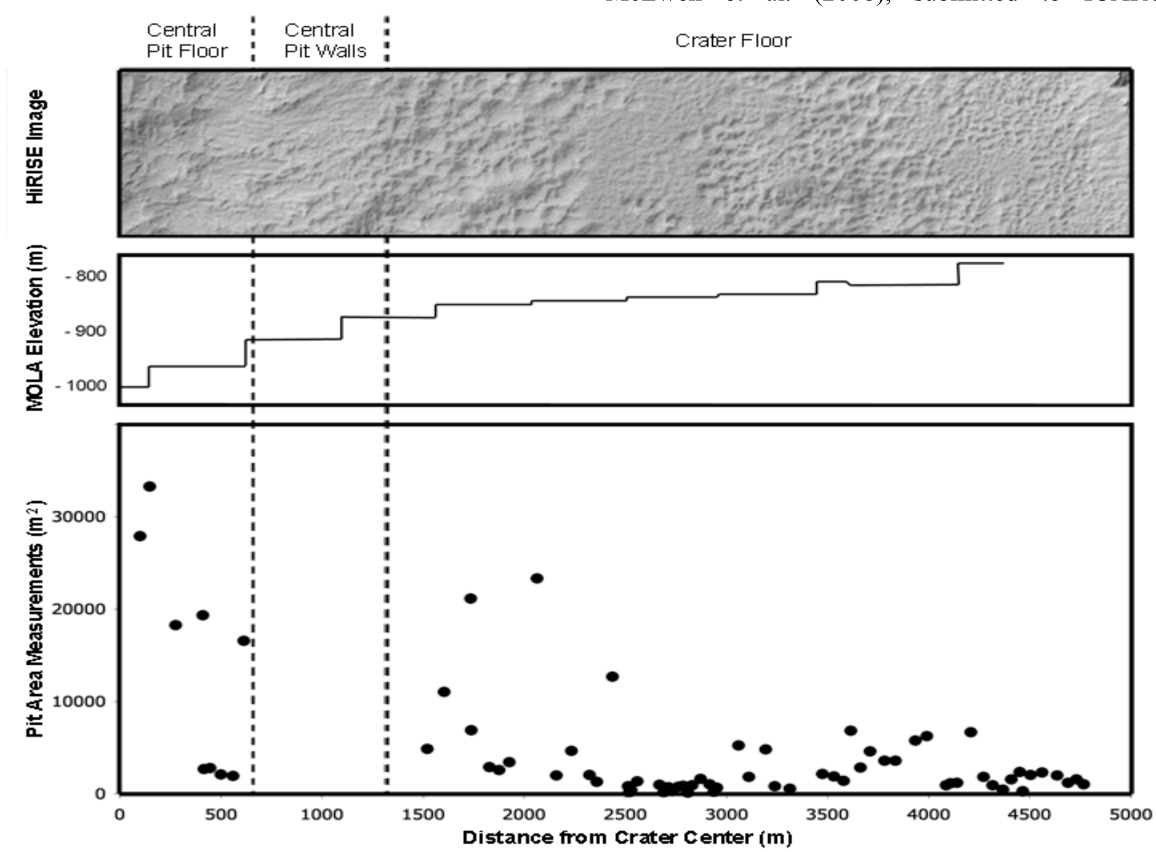

Fig. 3: HiRISE image (top), MOLA gridded DEM at 128 pix/degree (middle) and graph of pit area measurements (bottom) along the linear study area shown in Fig. 1.