

HIGH-RESOLUTION GEOLOGIC MAPPING OF URVARA CRATER, CERES

H. G. Sizemore¹, D. A. Crown¹, D. P. O'Brien¹, D. C. Berman¹, D. L. Buczkowski²,
J. E. C. Scully³, and A. Neesemann⁴

¹Planetary Science Institute (sizemore@psi.edu), ²Johns-Hopkins University Applied Physics Laboratory,
³Jet Propulsion Laboratory, ⁴Freie Universität Berlin.

ABSTRACT

Project Overview:

Objectives: We plan to develop a detailed geologic map and accompanying chronostratigraphy of Urvara crater, Ceres, based on high-resolution image data (3.5-20 m/px) acquired at the end of the Dawn mission. Crater diameter: 170 km. Map region: -128° to -93° E longitude, -59° to -35° N latitude. Publication scale: 1:250,000. Digitization scale: 1:50,000.

Science drivers: Two major landscape development questions arose from the Dawn mission at Ceres: What was the role of impacts in facilitating the development of putative cryovolcanic landforms? And to what degree did individual large impacts contribute to observed regional and hemispheric variation in crustal ice content? Reconstructing the chronological evolution of individual crater interiors and ejecta deposits is critical to addressing both questions. Recent analysis and mapping based on high-resolution images of Occator crater, Ceres, have produced a detailed chronological sequence of crater floor evolution and strengthened the case for prolonged hydrothermal activity and/or cryovolcanism at Occator [1,2]. Performing a comparable analysis at Urvara will allow us to evaluate whether extrusive processes have occurred at Urvara and draw conclusions about crater evolution and the impact redistribution of volatiles that have global relevance for Ceres.

Products & Schedule: Our project was selected through the Discovery Data Analysis Program (DDAP) in April 2020. This effort builds on a previous geologic map of Urvara [3] and will result in three types of science products:

Image mosaics. We will produce three controlled mosaics of the Urvara interior and rim using Framing Camera (FC) images from Dawn's 2nd extended mission (XM2). We have already produced preliminary versions of these mosaics and provided them to USGS for inclusion in our map package. Final versions will be developed in late 2020-2021 and archived with the PDS.

Expanded Ceres' crater database. We will expand an existing global database of Ceres' craters [4] to crater diameters of ~200 km in the map area. We will use crater size-frequency distributions (CSFD) to inform the Correlation of Map Units (COMU) and to provide absolute model age estimates for all mapped units in Urvara.

SIM map & journal publications. Our effort will result in a USGS-SIM map delivered in early 2023 and up to two peer-reviewed journal articles.

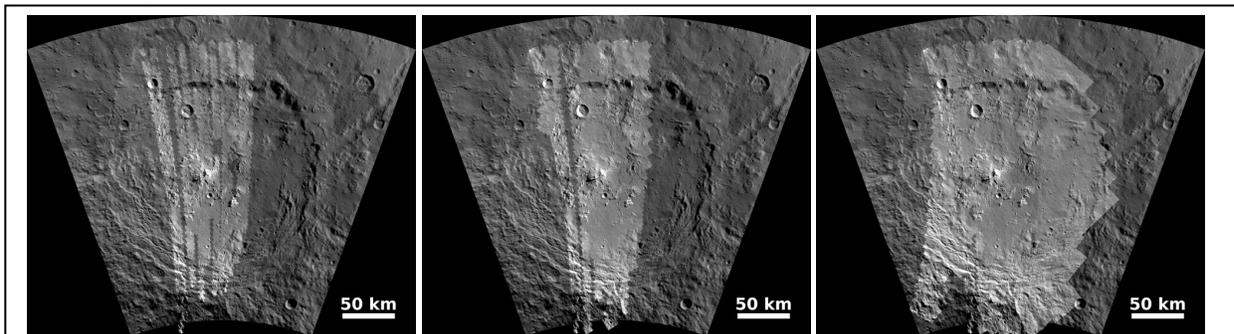


Figure 1. XM2 coverage of Urvara at different resolutions, overlaid on the 35 m/px Low Altitude Mapping Orbit (LAMO) mosaic. Left to right: <5 m/px, <10 m/px, and all available XM2 data. A small subset of the XM2 images covering the easternmost portion of Urvara have resolutions of ~40 m/px.

References: [1] Scully J. E. C. et al (2019) *Icarus*, 320, 213-225. [2] Scully J. E. C et al. (2020) *Nat. Geosci.*, in press. [3] Crown D. A. et al. (2018) *Icarus*, 316, 167-190. [4] Neesemann A. et al. (2019) *Icarus*, 320, 60-82.

Acknowledgments: We gratefully acknowledge the use of Dawn FC2 (Framing Camera 2) level 1b calibrated images available on the PDS Small Bodies Node:

(Nathues et al., 2016; <https://sbn.psi.edu/pds/resource/dawn/dwnfcL1.html>).