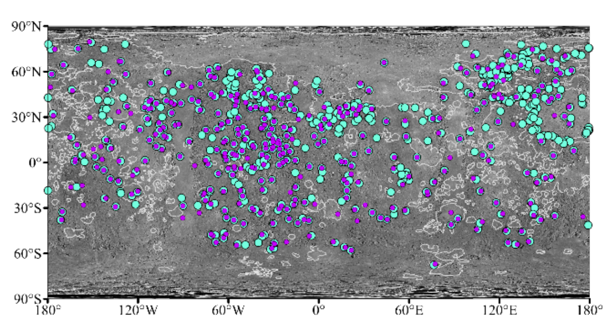
CHARACTERIZATION OF HOLLOW LOCATIONS INSIDE CRATERS OF DIFFERENT DEGRADATION INDICES ON MERCURY. E. Giroud-Proeschel[1], C. L. Johnson[1,2], A. M. Jellinek[1], [1]Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver, BC, V6T1Z4, Canada (elisabeth.giroud-proeschel@ubc.ca, cjohnson@eoas.ubc.ca, mjellinek@eoas.ubc.ca) [2]Planetary Science Institute, Tucson, AZ 86819, USA (cjohnson@psi.edu)

Introduction: Hollows are steep-walled, ~1 km-wide rimless depressions. Commonly associated with bright deposits possibly related to volatile loss [1,2], these features are usually found in clusters within craters and their surrounding ejecta, as well as in areas of low reflectance material (LRM) [2]. Within individual craters, hollow location depends on crater type (simple, complex) and degradation state [2]. At complex craters, hollows occur on proximal ejecta blankets and on the crater walls, floors and central structures. At simple craters, hollows form bands at the tops of crater walls. Hollows also occur on cross-cutting faults or in superposed craters. Here, we further characterize relationships among the locations of hollows on crater walls, floors and central structures and the degradation class of host craters [3]. Our goal is to provide new observational constraints for processes governing the formation, evolution and timing of hollows inside impact craters.

Data sets: We use a published data set of hollow groups [2] and craters from the named crater database at the PDS Geosciences Node Mercury Orbital Data Explorer to identify hollows inside impact craters. From this crater subset, we retain only those with a degradation classification index [3]. Fig. 1a clearly shows that most hollow groups from [2] occur inside impact craters and also shows the locations of the 28 additional craters containing hollows identified here. In total we consider 159 craters that contain hollows and for which a degradation index is available [3] (Fig 1b).

For each crater, we use MDIS Narrow-angle Experiment Data Record (EDRNAC) and Regional Targeted Mosaics (RTMs) [4-6] to identify hollows at one or more of five type locations: the crater wall (*W*), floor (*F*), intersections between the wall and floor (*I*), central structures (*C*) and superposed craters (*S*) (Fig. 2).



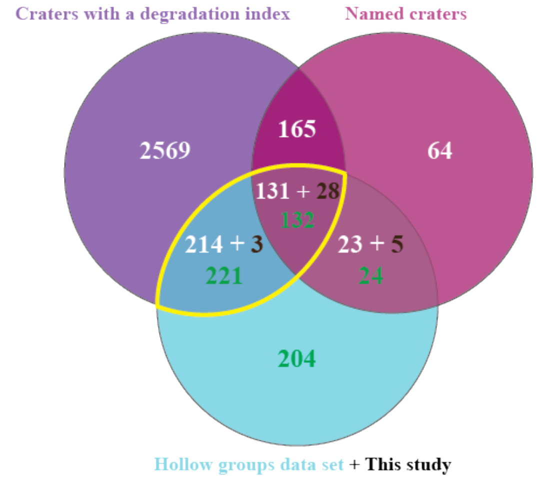


Figure 1: (a) Map of data sets featured in this study. Light blue filled circles show hollow groups identified by [2], purple filled circles indicate hollows inside craters with a degradation index [3], identified in this study. The basemap is MESSENGER MDIS Global BDR [4], (b) Venn diagram showing the distinct crater and hollow group data sets contributing to this study. Numbers in green indicate numbers of hollow groups, numbers in white and in black indicate numbers of distinct craters in each data subset. The subset of data outlined by the thick yellow line is that used in our study.

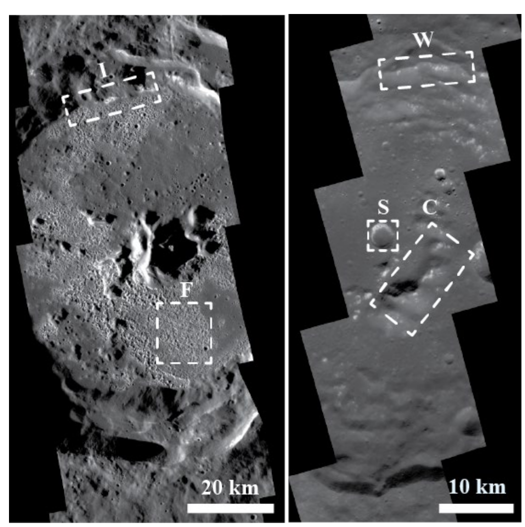


Figure 2: Aspects of hollow morphology at key locations in two fresh (Class 4) impact craters. Examples of wall (W), floor (F), intersection (I), central

structure (C) and superposed crater (S) hollows are outlined by white dashed boxes. (A) Hollows on the floor, peak and intersection of Sander crater (42.4156°N, 154.629°W). RTMNAC image ID: N01_005301_2199165_1. (B) Hollows on the walls, peak and within superposed craters in Boznanska crater (59.6125°N, 40.6922°E). RTMNAC image ID: N01_002998_0833064_1.

Results: We find that ~40% of hollow occurrences inside fresh craters (degradation classes 4 and 5) are on or within the central structure. At more degraded craters (degradation classes 1 and 2), ~50% to ~80% of hollow occurrences are inside superposed craters (Fig. 3).

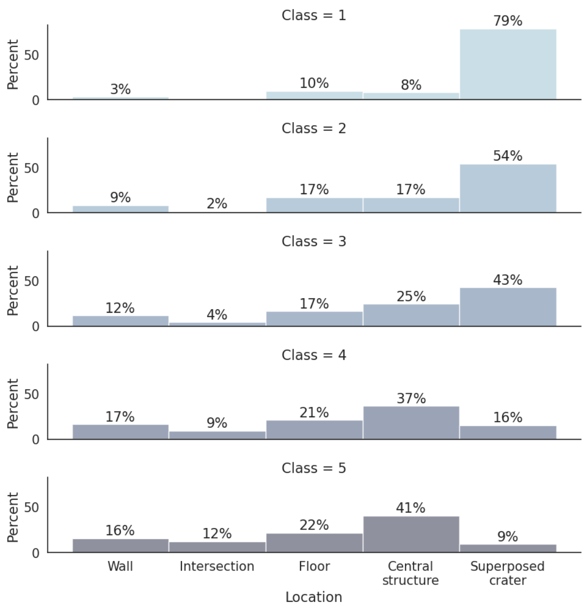


Figure 3: Percentage of hollow occurrences at each crater location for each crater degradation class.

Overall, the more degraded a crater is, the more likely it is that hollows occurring inside that crater will be inside superposed craters and there is a corresponding decrease in the proportion of hollow occurrences at the wall, floor, intersection and central structure. However, even in heavily degraded craters, hollows are still sometimes found on the floor and central structures.

Discussion: Our results raise several key, outstanding questions related to the formation of hollows inside impact craters. Do hollows form shortly after their host crater? Can new hollows form in degraded craters? Can hollows continue to evolve in shape and structure as their host crater degrades, in response to processes that disrupt the surface such as mass wasting and cratering? A relative dearth of hollows at the wall, intersection, floor and central structures of more degraded craters may imply that hollows nucleate at these locations shortly after the host crater forms and are erased as it degrades. However, the existence of at least some hollows at the floors of degraded impact craters suggests that they also may continue to form and grow on the floor of impact craters as they age. At more degraded craters, the larger proportion of hollows inside superposed craters cf. other locations within the crater is consistent with the nucleation of new hollows by further impact cratering. Moreover, as most hollows in superposed craters are found in small simple craters, these hollows have likely nucleated from shallow depths within the host crater. Additionally, the observation that hollows occur mainly at the central structure in relatively fresh craters suggests links among hollow formation, excavation by impacts and the underlying structure and composition of the target terrain in which the crater formed.

References: [1] Blewett, D. T. et al. (2011) *Science*, 333(6051), 1856-1859. [2] Thomas, R. J. et al. (2014) *Icarus*, 229, 221-235. [3] Kinczyk, M. J. et al (2020). *Icarus*, 341, 113637. [4] Hash, C. D. (2016) *NASA PDS,* https://doi.org/10.17189/1520406 [5] Hash, C. D. (2015) *NASA PDS,* https://doi.org/10.17189/1520380 [6] Hash, C. D. (2016). *NASA PDS*, https://doi.org/10.17189/1520399