DISTRIBUTION CHARACTERISTICS OF MARTIAN SOUTHERN MID-LATITUDE POLLYWOG CRATERS. S. A. Wilson[1] and A. D. Howard[2], [1]Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, MRC 315, PO Box 37012, Washington DC 20013-7012. (purdys@si.edu) [2]Planetary Science Institute, 1700 East Fort Lowell, Suite 106, Tucson, AZ 85719-2395 (ahoward@psi.edu).

Introduction: Small (~≤15 km diameter), fresh craters with channelized exit breaches (but with no contributing area external to the crater rim) (**Fig. 1a**) are a recently identified landform that record a period of late occurring (< 3.5 Ga) fluvial erosion [*1, 2*]. The outlet channel(s) formed as water from within the crater overspilled the rim. To understand the geologic significance, associated hydrology, and climate that permitted the formation of these "pollywog" craters, we are characterizing their global distribution in relation to variables such as latitude, diameter, slope, elevation, geology, and correlation to other landforms. Here, we report partial results of a global characterization of martian pollywog craters between 28°S and 52°S.

Data and Inventory Procedures: We utilized the preliminary CTX global database [*3*] imported into ArcGIS within the surveyed latitude band. The image dataset was systematically searched at a projected scale of 1:100,000. Craters with possible exit breaches were classified into three reliability classes: ***Firm:*** The crater has one or more eroded notches on its rim with at least one identifiable valley extending outward from a notch. ***Probable:*** A crater has at least one rim notch, but the linear depression extending outward from the notch is either indistinct or short relative to the crater size. ***Possible:*** A crater has a rim notch but a valley extending from the rim is very indistinct.

Craters were eliminated from consideration if 1) a crater rim notch were likely due to a superimposed impact crater (e.g., having a distinctly rounded form); 2) fluvial activity from outside the natural fresh crater rim location might contribute to the drainage (e.g., if the crater were superimposed on the outer rim of a larger crater with possible upslope drainage crossing the rim location); 3) topographic or image resolution made it unclear whether a channel crossing the rim were entering or leaving the crater, or 4) CTX image quality were insufficient to assess for exit breaches (e.g., no coverage, hazy or low contrast images, or obscuration by dust devil tracks). CTX image quality becomes a strongly limiting factor in latitudes south of ~50°S.

A reasonably inclusive assessment of exit breaches and internal-only drainage was used for craters characterized as *possible* pollywogs, so that a large proportion of these craters are likely not pollywog craters. A majority of craters with a *probable* pollywog characterization may be actual pollywogs, but they would require further assessment (e.g. use of CTX or HiRISE stereo imaging) to update to a *firm* classification. The preliminary analysis we present below includes only craters in the *firm* category.

Each crater included in the pollywog survey was linked to the Robbins et al. global database [*4, 5*] (except for the few cases where pollywog craters were less than 1 km in diameter) to extract the crater diameter.

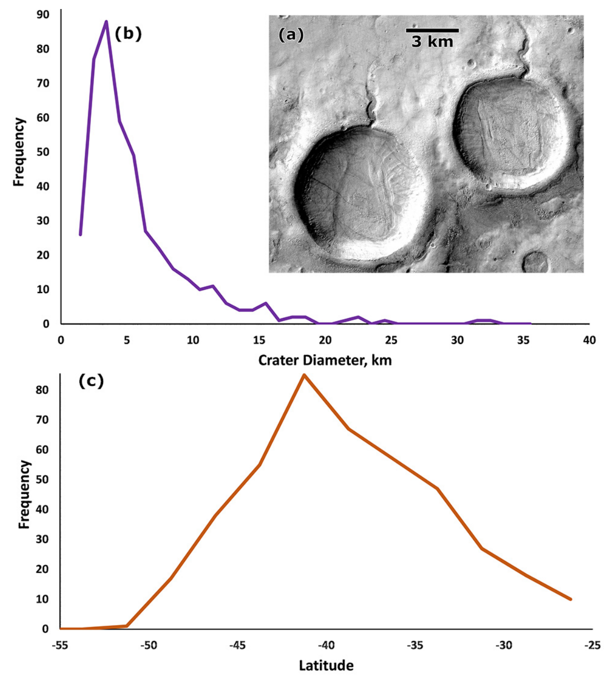

Figure 1. Distribution characteristics of "firm" pollywog craters in the southern hemisphere of Mars. (a) Example pollywog craters; (b) Frequency distribution of host crater diameters. (c) Latitudinal distribution of pollywog craters**.**

Geographical Distribution: Pollywog craters are widely distributed across the entire range of longitudes between 28°S and 52°S latitude (**Fig. 2**). *Possible* and *probable* pollywog craters are distributed across the entire latitude range. The 403 *firm* pollywog craters, however are more restricted in latitude, with few north of 28°S or south of 50°S. (**Fig. 1c**). The *firm* pollywogs are also rare on the floor of the Hellas and Argyre basins and on the Tharsis highlands. The highest concentration of pollywog craters is strongly clustered around 40°S, which is the same mid latitude belt with ice related landforms, including concentric crater fills, viscous flow features, fresh shallow valleys, lineated valley fills, and asymmetrical crater floors [*2, 6-9*].

Size Range of Pollywog Craters: Pollywog craters in the northern Arabia region were noted to fall primarily below 10 km host crater diameters, clustering at about 4 km diameter [*2*]. This pattern is also observed in the southern latitudes with crater diameters strongly clustered about the 3.4 km mode (**Fig. 1b**). The sharp drop-off of pollywog craters less than 1 km in diameter may be limited to some extent by image resolution, particularly in recognition of crater notches and valleys. A probable factor in the few small craters featuring pollywogs is the difficulty in generating intense enough crater rim overflow to erode the rim notch and to excavate a valley across the ejecta blanket. The rapid decrease in pollywog craters greater than about 5 km diameter may result from several factors. Pollywog craters tend to be fairly fresh (young) in morphology - the high depth/width ratio of young craters may be a contributing factor to the hydrology. Larger craters are generally more degraded and the lower elevation floors tend to attract exterior drainage.

Continuing Analyses: In the second phase of the study we will examine the local topographic characteristics of *firm* pollywog craters (e.g., crater interior depth, exterior slopes), state of crater degradation, association with fresh, shallow valleys, azimuth distribution of breaches, etc. The survey will also be extended to the northern hemisphere and to portions of the equatorial region to confirm the paucity of pollywog craters there. A model of the overspilling erosion of pollywog craters by snow accumulation or groundwater upwelling [*1*] has difficulty of explaining the paucity of large pollywog craters or the limited degree of breach erosion. Completion of the present survey and analyses should help constrain future models.

References: [1] Warren, A.O. *et al.*, (2021), *EPSL* **554**, doi:/10.1016/j.epsl.2020.116671; [2] Wilson, S. A. *et al.*, (2016), *JGR Pl* **121**, 1667-94, doi:10.002/ 2016JE005052; [3] Dickson, J. *et al.*, (2018), *49th LPSC,* Abs. 2840; [4] Robbins, S. J., Hynek, B. M., (2012), *JGR* **117**, doi:10.1029 /2011JE003996; [5] Robbins, S. J., Hynek, B. M., (2012), *JGR* **117**, doi:10.1029/2011JE003967; [6] Kreslavsky, M. A., (2003), *GRL* **30,** doi:10.1029/ 2003GL0017995; [7]Levy, J. *et al.*, (2010), *Icarus* **209**, 390-404; [8] Milliken, R. E. *et al.*, (2003), *JGR Pl* **108**, 5057, DOI 10.1029/2002JE002005; [9] Voelker, M. *et al.*, (2020), *Icarus* **346**, doi:/10.1016/ j.icarus.2020.113806.

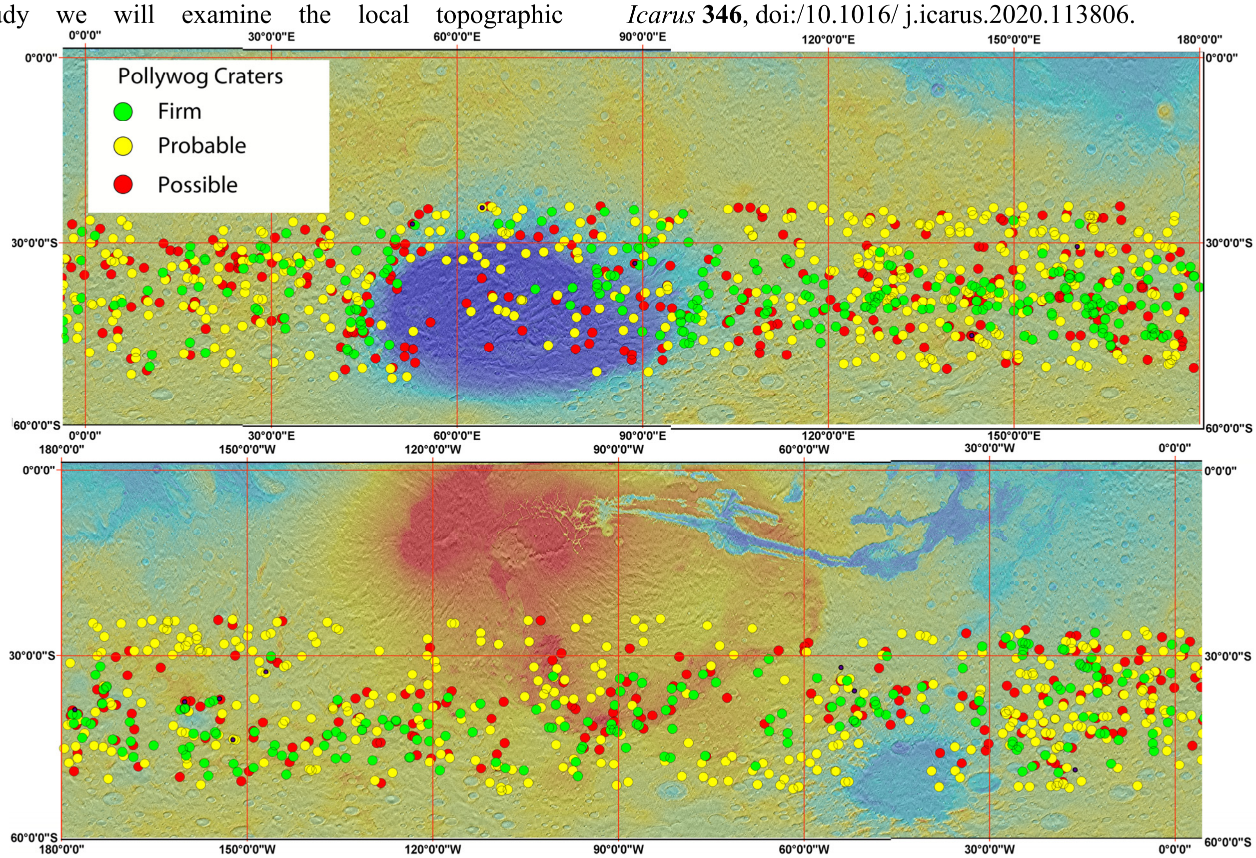

Figure 2. Distribution of pollywog craters in the southern hemisphere of Mars. Craters are stratified by reliability of identification.