EVIDENCE FOR LATE DRAINAGE ALONG PORTIONS OF SAMARA VALLES, MARGARITIFER TERRA, MARS. J. A. Grant[1], R. Manogaran[2], and S. A. Wilson[1], [1]Smithsonian National Air and Space Museum, Center for Earth and Planetary Studies, 6th at Independence SW, Washington, DC, 20560, grantj@si.edu, purdys@si.edu [2]Louisiana State University, Department of Geology and Geophysics, Baton Rouge, LA 70803, rmanog1@lsu.edu.

Introduction: The Margaritifer Terra region hosts a diversity of fluvial features that record a long history of aqueous processes and drain nearly 10% of Mars (**Fig. 1**). Mapping [*1-9*] provides a framework for evaluating the geologic and fluvial evolution of the region. Major events that shaped the surface include the formation of the Ladon and Holden multi-ringed impact basins [*10*], which are the oldest relict features. The basins and their rings controlled regional drainage throughout the exposed geologic record. The region is also divided by the Chryse trough [*11*] that decreases in elevation northward causing drainages to converge into Margaritifer basin [*8, 12*]. Topography associated with these features together with relief created by impact craters defines drainage basins for the Samara-Himera and Parana-Loire valley networks that dominate drainage on the east flank of the Chryse trough (**Fig. 1**).

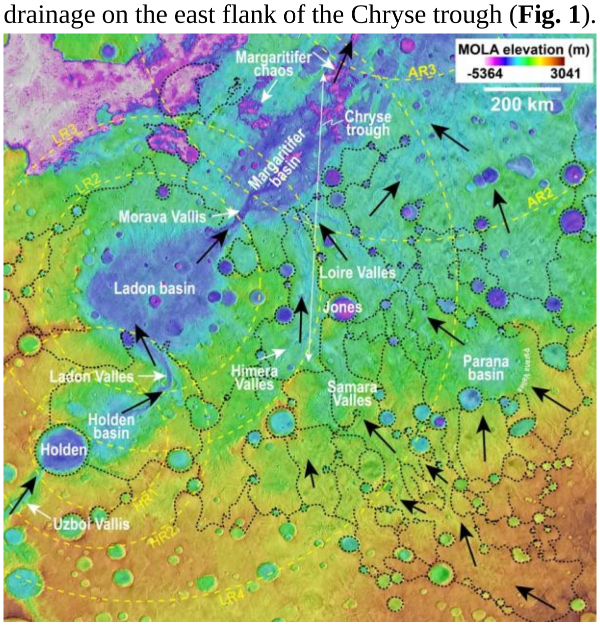

Fig. 1. Margaritifer Terra region (5° to 35°S and 325° to 350°E). Drainage basin boundaries (dashed black [*2, 13-14*]) and routed flow (black arrows) were influenced by remnant topography of the Chryse trough (axis white double arrow), and multi-ringed impact basins (basin rings are yellow dashed lines [*10*]). MOLA [*15*] color elevation over THEMIS daytime IR [*16-17*]. North up.

Regional Valley Systems: The Samara-Himera and Parana-Loire valley systems [*2, 13-14*] preserve the highest density of valleys on Mars. The drainages mostly formed in the late-Noachian into the Hesperian [*2, 4*] and have been the subject of morphometric and hypsometric analyses [e.g., *13, 18*. The Samara-Himera watershed encompasses over 300,000 km^2 and drains northwestward to Margaritifer basin (**Fig. 1**). The system has a degraded expression, yet several medial segments west of Jones crater (19°S, 341°E) appear more pristine (**Fig. 2**) [*19-20*] and are likely younger than segments further south as described below.

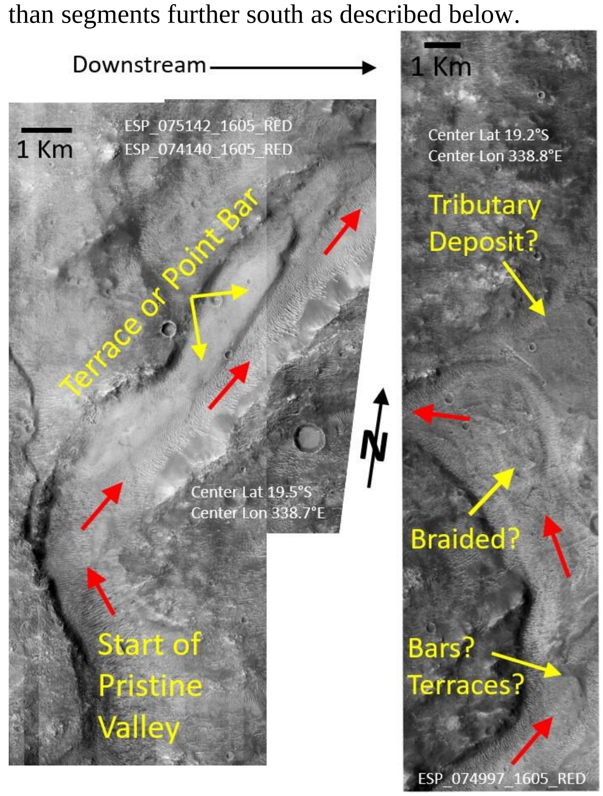

Fig. 2. Examples of relatively pristine Samara Valles segments west of Jones crater that are well-incised and preserve interior terraces or depositional bars (red arrows denote flow direction). A series of forms along the floor resembles a braided pattern near entry of a possible tributary off the western flank of Jones. The HiRISE images [*21*] are shown side-by-side for ease of presentation. Resolution is 0.25-0.50 m-pixel scale.

Relatively Pristine Valley Segments: Pristine segments appear to originate within the Jones ejecta where their expression varies from well-incised to diffuse. Some reaches appear anastomosing or somewhat braided and truncate one another, whereas others may occupy an older valley and are more than a kilometer across and 100s of meters deep. There are examples of interior terraces or depositional forms (**Fig. 2**). More pristine segments persist to the north and there are associated finely layered, alternating dark- and light-toned deposits that partially fill a crater. MOLA topography [*15*] on the west flank of Jones reveals few potential tributaries to the more pristine segments.

A Model for Evolution of Pristine Segments: The more pristine Samara Valles segments may be the result of late discharge sourced by melting ice and (or) water in and below the Jones crater ejecta after formation of the crater. A comparable scenario is hypothesized for late drainage around the younger Hale crater [*22-24*]. Valleys incising Jones ejecta require that late drainage occurred no earlier than the Late Hesperian [*19-20*] and likely soon after the formation of Jones crater.

In this model, water emerged west of Jones due to slope on the flank of the Chryse trough and then drained northward along the axis of the trough. Elsewhere, water would be directed westward, with some perhaps bypassing the crater to the north and south, but resulting in limited surface discharge to the east [*19*] where valleys appear buried by Jones ejecta.

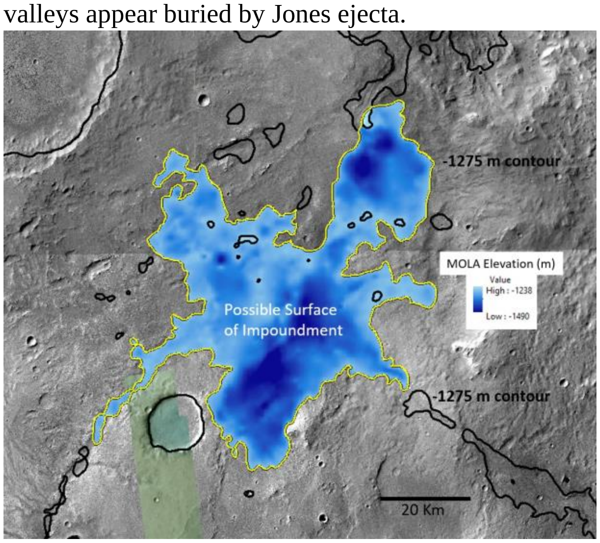

Fig. 3. An estimated 46 km^3 of water may have filled a basin upstream of the well-incised, more pristine valley segments. Water may have accumulated via downslope migration of water in and beneath the Jones crater ejecta and eventually overtopped the confining divide. Basin volume estimate was derived in ArcGIS using the Mars MGS MOLA – MEX HRSC Blended global DEM (1275 m contour highlighted).

Pristine segments SW of Jones are relatively small and less incised compared to those further north. Local topography indicates water would have been impounded just downstream in a basin WSW of Jones before overtopping and draining further north. The MOLA contour of -1275 m [*15*] consistently traces the pristine valleys and intervening basins (**Fig. 3**) and indicates 40-50 km^3 of water would have accumulated before breaching the divide and rapidly discharging downstream. High discharge from the basin is supported by the much-increased valley dimension north of the basin and discharge estimates on order of 10^4 m^{3}sec^{-1} at a downstream terrace/depositional form (**Fig. 2**). Flow may have been augmented by some water from the flank of Jones before overwhelming a smaller downstream basin with a volume of 6-7 km^3. Water then continued northward via anastomosing valleys that eventually coalesced before perhaps reaching Margaritifer basin.

Summary: We believe the morphometry and distribution of the relatively pristine Samara Valles segments are most consistent with formation by water released after Jones crater formed. Downslope drainage of water released and (or) melted by the impact would be analogous to what occurred around Hale crater [*22-24*]. If correct, our model indicates late discharge was during a geologically brief interval unrelated to global climate. Nevertheless, the presence of surface water reservoirs and active fluvial processes likely created transient habitable environments relatively late in Mars history.

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