A GEOLOGIC CHARACTERIZATION OF LADON VALLES, MARS, AND VICINITY. Doug C. Wolfinger[1] and Keith. A. Milam[1], [1]Department of Geological Sciences, 316 Clippinger Laboratories, Ohio University (dw538511@ohio.edu).

Introduction: Ladon Vallis and Ladon Basin, Mars (Ladon study area) (Fig. 1), are in the path of what is potentially the solar system's longest fluvial system [1]. A reconstruction of the geologic conditions that formed the flow path is vital to understanding geologic conditions on early Mars. An integral part of this reconstruction is the determination of the geologic process(es) that formed Ladon Vallis. Although previous workers have referred to Ladon Vallis as an "outflow system" or "outflow channel system", there has not been a formal geologic characterization that has led to that determination.

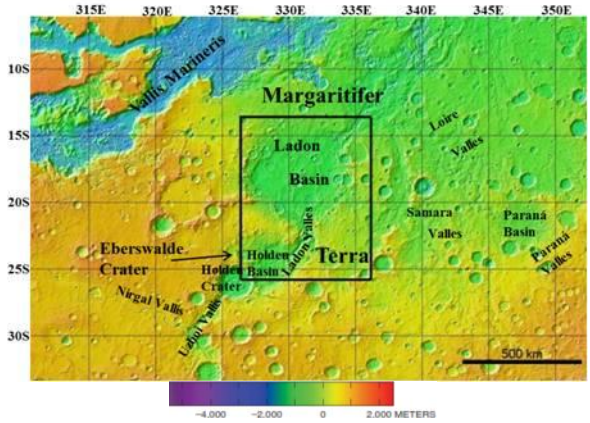

Figure 1 The Ladon study area is boxed. Warmer and cooler colors denote areas of higher and lower elevations, respectively. Elevation scalebar from [2]. Base map data: MOLA Shaded Relief / Colorized Elevation.

Questions: This study builds on the minimal number of previous studies of Ladon Valles and attempts to answer the following outstanding questions:

- Is Ladon Vallis an outflow channel that formed by cataclysmic flooding?
- What were the discharge rates for Ladon Vallis? How do they compare with that presented in [2], with that of other outflow channels on Earth and Mars, and with other types of channels?
- What was the timing and duration of flow through Ladon Vallis in relation to Holden crater and other features (e.g. Ladon Basin) in the region?

Methods: An assessment of Ladon Valles's landforms and discharge was implemented in an effort to determine what type of erosional landform Ladon Valles represents and to relate it to other channels of the same type. Timing and duration of events was assessed by mapping the Ladon study area's geologic units, based primarily on their morphologic characteristics, and dating them using the crater size-frequency retention model in [4]. Multiple datasets were used in this analysis, including Context Camera (CTX) and Thermal Emission Imaging Spectrometer (THEMIS) onboard Mars Reconnaissance Orbiter, and Mars Global Surveyor's Mars Orbiter Laser Altimeter.

Results: Ladon Valles's streamlined islands, anastomosing channels (Fig. 2), and high aspect ratio (~16:1 in the main channel's deepest section) are most comparable to the landforms and aspect ratios of other outflow channels.

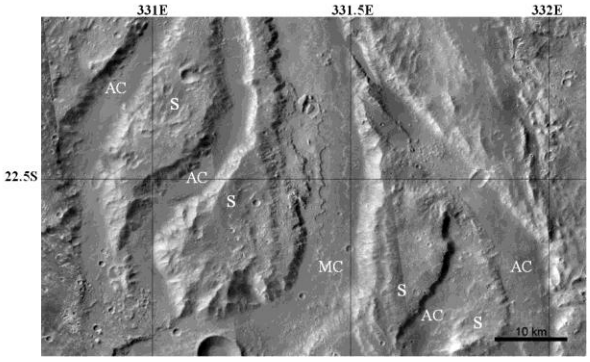

Figure 2 Ladon Valles's streamlined islands (S), anastomosing channels (AC), and main channel (MC). Base map data: THEMIS daytime IR.

Discharge estimates for the anastomosing channels and main channel range from 2.0×10^6 to 1.9×10^9 $m^3 s^{-1}$, with the highest discharges occurring at early stages in the main channel. Geologic units (Fig. 3) in the Ladon study area range in age from the Early to Late Noachian Ages. Overland flow was episodic through Holden Basin in the Early to Middle Noachian, when Ladon Valles's initial five channels were formed. Flooding eventually became concentrated in the main channel (Fig. 3) and occurred in at least three stages. At least one of these final main channel stages may well have initiated from Holden Crater following its formation. Fluvial depositon occurred into Ladon Basin from the Ladon outflow system, as well as from the Ladon study area's valley networks, such those in as Arda Valles and Ladon Uplands (Fig. 3) throughout the Noachian Period, with a significant majority of sediment being deposited in the Early and Middle Noachian. Chaotic flooding likely occurred in the Late Noachian from the northeastern corner of Ladon Basin to form Morava

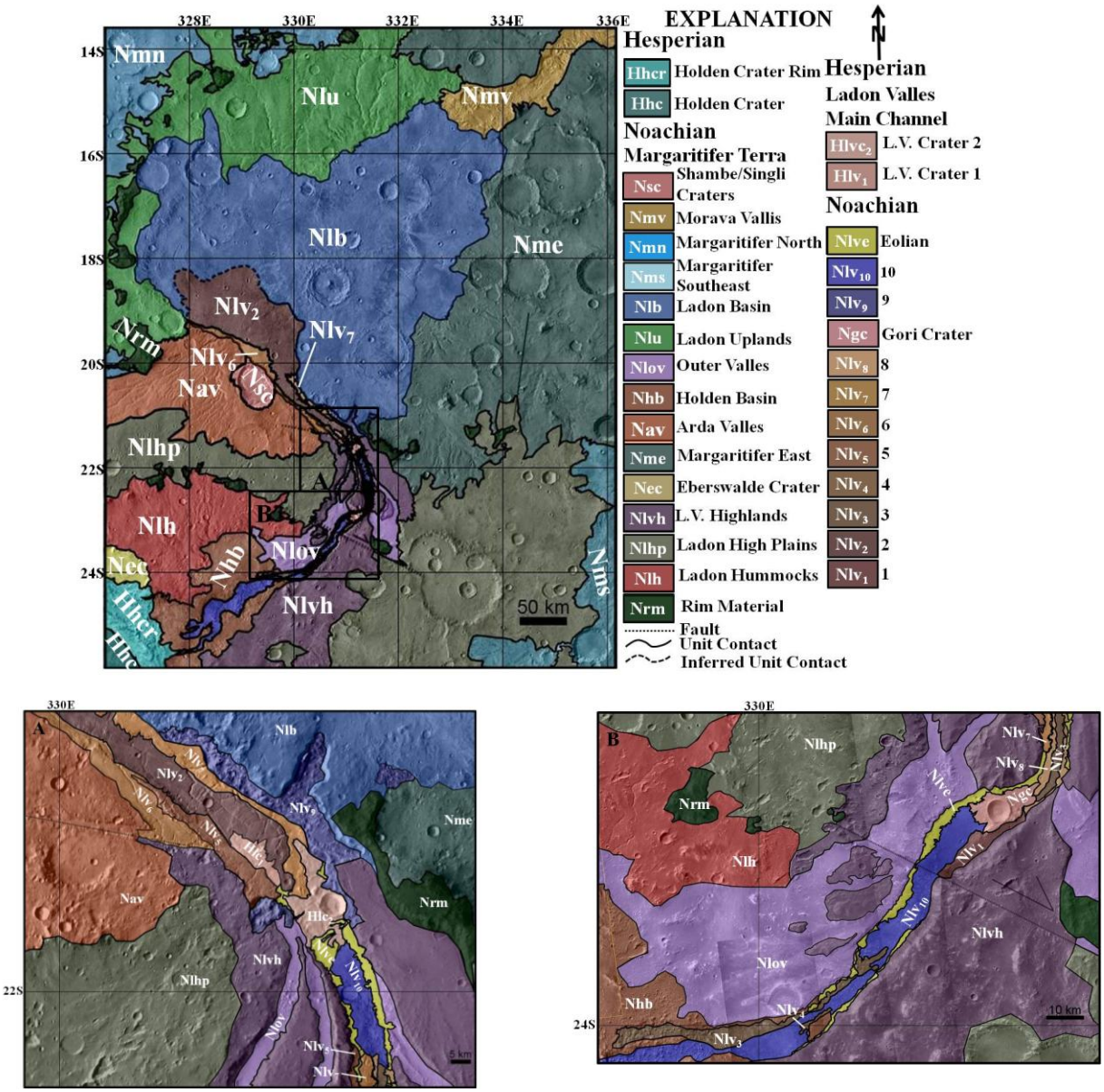

Figure 2 Geologic map of Ladon Valles, Mars, and vicinity. Base map data: THEMIS daytime IR ***(a)*** *Inset of part of northern Ladon Valles.* ***(b)*** *Inset of part of southern Ladon Valles. Base map data for (a) and b): CTX images.*

Vallis. Fluvial activity likely came to an end in the Ladon study are approximately 3.5 Ga.

Summary: Aspects of Ladon Valles are consistent with its characterization as an outflow system, based on landforms, geometric dimensions and discharge estimates presented in this work. Discharge estimates for the Ladon outflow system exceed the estimate in [2] at least by an order of magnitude, and all are within the range of outflow channel discharge. The discharge estimates and channel geometry of Ladon Valles indicate that it served as a prominent fluvial connection between Holden Basin and Ladon Basin in the Noachian Period. It would have been an integral link in what may have been the solar system's longest flow path. Therefore, it is a strong possibility that the water volume required to supply the flow path extending from the South Polar region to Chryse Planitia was present.

References: [1] Carr, M. (2006) Cambridge Planetary Science, 307. [2] Fortezzo, C. et al (2009) MTMS -15017, -20002, -20007, 020017, 020022, 025002, 025007. [3] Grant, J. A. and Parker, T. J. (2002) *JGR, 107,* 1–19. [4] Hartmann, W. K. (2005) *Icarus., 174,* 294–320.