MAPPING SINUOUS RIDGES AND PRELIMINARY FLUVIAL MEASUREMENTS IN NORTHWEST HELLAS, MARS. A. L. Gullikson[1], R. B. Anderson[1], R. M. E. Williams[2] [1]U.S. Geological Survey, Astrogeology Science Center, 2255 N. Gemini Drive, Flagstaff, AZ 86001, [2]Planetary Science Institute, 1700 E. Fort Lowell, Suite 106, Tucson, AZ 85719.

Introduction: Evidence for flowing water on the surface of Mars has been recognized since the Mariner 9 mission, when images were returned showing extensive dendritic valley networks [1]. With increasingly high resolution images afforded by more recent orbiter missions, numerous potential fluvial features such as stream channels and sinuous ridges have been identified. Work presented here focuses on sinuous ridges, which are primarily interpreted to be inverted fluvial channels, though eskers are also possible in some instances [e.g., 2-6].

Although related to flowing liquid water, sinuous ridges are understudied in comparison to martian valley networks. Sinuous ridge occurrences were documented on a global scale using data from the Mars Orbital Camera (MOC) and the Thermal Emission Imaging System (THEMIS) by [7], but no large-scale maps tracing the morphology of these features, comparable to the global maps of valley networks [8], exist. We present the results of an ongoing effort to map sinuous ridges in a large region of interest (-15°N to -45°N, 30°E to 75°E) in northwestern Hellas and preliminary fluvial discharge measurements for sinuous ridges located within intercrater alluvial fan deposits..

Methods: The primary data used in this study are images from the Mars Reconnaissance Orbiter (MRO) Context Camera (CTX). CTX has observed >99% of the surface of Mars at a resolution of 6 m/pix. This large dataset, with a combination of high resolution and good spatial coverage, permits regional and global mapping of sinuous ridges at a scale that was previously not possible. Ridges are mapped at a scale of ~1:20,000, using CTX data exclusively to ensure that the detection threshold of the mapped features is not biased by the availability of multiple datasets with different resolution. We have used the 1:20M scale global geologic map [9] and the 1:5M scale geologic map of Hellas by [10] to provide geologic context and approximate ages for the mapped features.

Although the primary focus of this study is mapping sinuous ridges for future morphometric work, we are also mapping valleys, canyons, and channels, as well as linear ridges interpreted to be tectonic in origin to provide a more comprehensive map of fluvial and ridge-like features within the northwestern portion of Hellas.

Hellas Basin: Hellas basin, centered at 42.4°S, 70.5°E, is located in the southern highlands of Mars. The northwestern portion of this basin and the adjacent highlands were selected for our study because this area incorporates terrain spanning a wide range of ages [9], and contains numerous sinuous ridges identified by [7]. A significant portion of the region of interest is composed of Noachian to Hesperian-aged units [9-11]. Previous studies have suggested that a climate shift on Mars could have occurred during this timeframe. This shift may be preserved in the fluvial features and their morphology within this region.

Much of the earlier work on Martian sinuous ridges has focused on studying such features in the Aeolis Dorsa region, within the Medusae Fossae Formation (MFF) [e.g., 5, 12-13], interpreted to be Hesperian to Amazonian in age [e.g., 9, 14-15]. Our work, which is based primarily in Noachian to Hesperian-aged units, will provide a useful point of comparison with the sinuous ridges that have been studied in the MFF.

Results: Our mapping area has been divided into 15 smaller sectors for mapping (**Figure 1**). Currently 9 of the 15 sectors are finished, and the remaining 6 will be completed this year.

Upon completion of sectors located to the north of Hellas, we observed that the majority of sinuous ridges mapped thus far are concentrated within intercrater alluvial fans (**Figure 1**). These features have been interpreted as inverted distributary channels, and fall within three broad fan morphology categories; negative relief "chute" morphology, inverted channel morphology, and degraded morphology, and have been discussed in detail by [16] and [17].

Width measurements of sinuous ridges are needed in order to estimate fluvial discharge. To maintain the highest accuracy for these measurements, High Resolution Imaging Science Experiment (HiRISE) imagery was used (0.25 cm/pix). Width measurements have been taken for ridges ≥200 m in length, and where possible, multiple width measurements spaced every 200 m were obtained. Ridges vary in shape, ranging from those with flat-tops and well-defined edges, to those that are so heavily-eroded that reliable width measurements are not possible. We therefore assigned every mapped sinuous ridge a confidence value ranging from 1 (highest width confidence) to 4 (unmeasurable). Preliminary empirical discharge estimations based on [18] yielded values of ~55 m^3/s for the alluvial fan located near the northern edge of sector 10 (**Figure 2a**), in the informally named "Crater L" by [19], and ~170 m^3/s for an alluvial fan located in Saheki crater (near the southern edge of sector 5) [17]. A discharge value of ~55 m^3/s is in agreement with previous work done by [20] in "Crater L", which estimated a discharge of 30-60 m^3/s [17].

Future Work: Work is ongoing to map sinuous ridges and other fluvial and ridge-like features within

the NW Hellas region. The mapping effort will be completed this year. The completed map will be used to determine whether relationships exist between sinuous ridges and different-aged terrain, mapped geologic units [e.g., 9, 10], the presence of hydrated minerals [e.g., 21-22], and layered deposits [e.g., 23] within the area. Discharge measurements for the remaining inverted alluvial fans and individual sinuous ridges (e.g. **Figure 2b**) will be carried out once mapping is complete.

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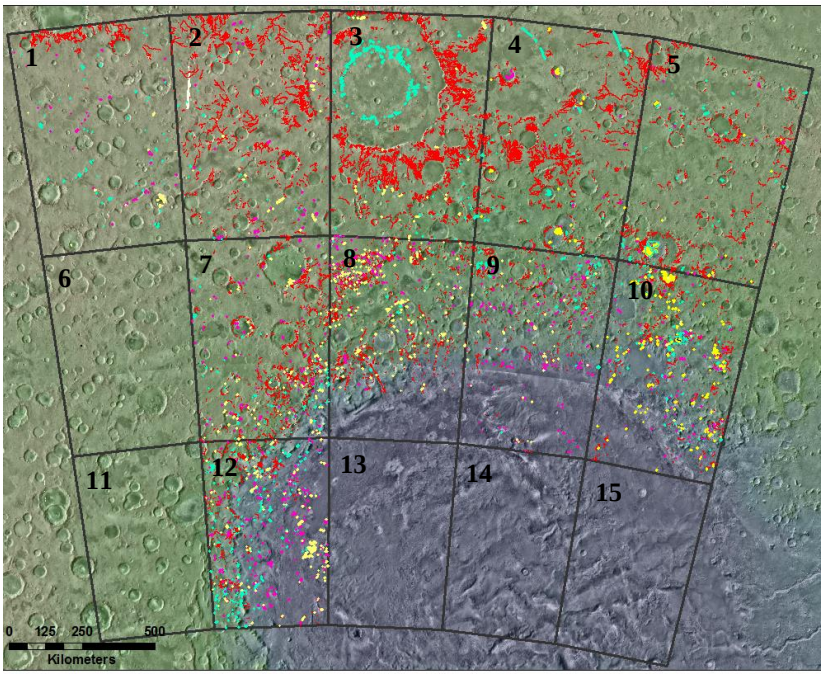

Figure 1. MOLA colorized base map of the NW Hellas region. The study site is subdivided into 15 sectors, denoted by numbers. Sectors 2-5, 7-10, and 12 have been fully mapped and sector 1 has been partially completed.

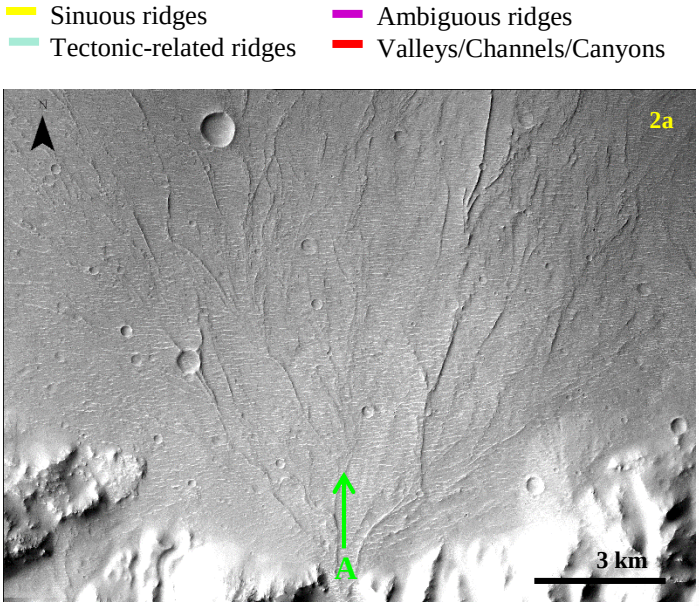

Figure 2. CTX images showing examples of sinuous ridges mapped in the NW Hellas region. Both images are located near the northern edge of sector 10. **2a** is an example of an inverted alluvial fan. Green arrow indicates flow direction and 'A' shows location of the apex. **2b** is an individual sinuous ridge. Yellow arrows point to the ridge.