

Introduction: Hesperia Planum, characterized by a high concentration of mare-type wrinkle ridges and ridge rings [1-4], encompasses > 2 million km² in the southern highlands of Mars (Fig. 1). The most common interpretation is that the plains were emplaced as “flood” lavas with total thicknesses of <3 km [4-10]. The wrinkle ridges on its surface make Hesperia Planum the type locale for “Hesperian-aged ridged plains” on Mars [e.g., 9], and wrinkle-ridge formation occurred in more than one episode [4]. Hesperia Planum’s stratigraphic position and crater-retention age [e.g., 9, 11-12] define the base of the Hesperian System. However, preliminary results of geologic mapping reveal that the whole of Hesperia Planum is unlikely to be composed of the same materials, emplaced at the same geologic time. To unravel these complexities, we are generating a 1:1.5M-scale geologic map of Hesperia Planum and its surroundings (Fig. 1). To date, we have identified 4 distinct plains units within Hesperia Planum and are attempting to determine the nature and relative ages of these materials (Fig. 2) [13-15].

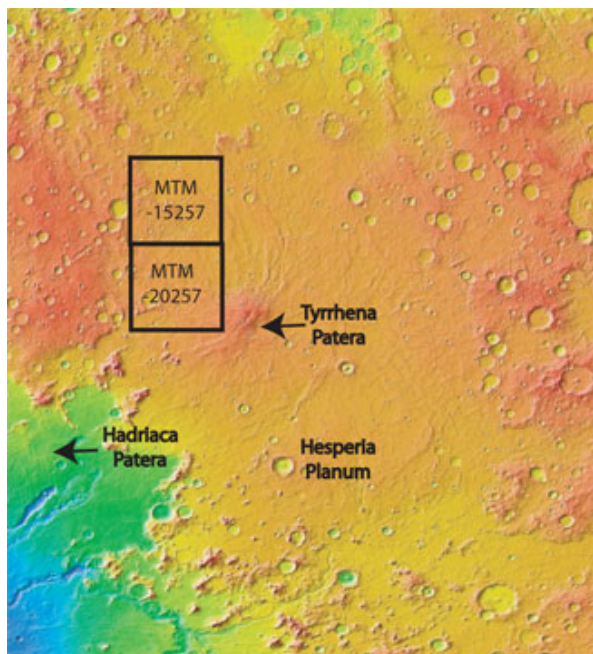


Figure 1. Gridded MOLA data (128 pixels/degree) of the Hesperia Planum region being mapped at 1:1.5 million. Reds are topographic highs (Tyrrhena Patera summit is ~3 km above mean planetary radius) and blues are lows. Locations of MTM quadrangles -15257 and -20257 noted.

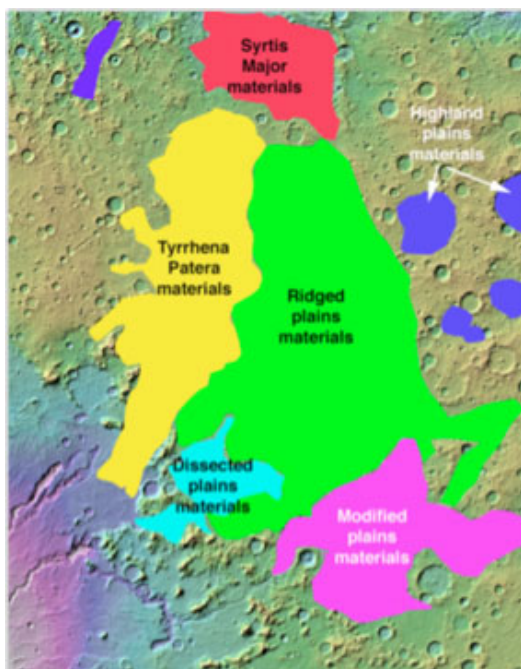


Figure 2. Rough boundaries of identified plains materials within Hesperia Planum. Portions of these materials were originally mapped as “Hesperian-aged ridged plains” at 1:15 million [9].

Hesperia Planum contains the volcano Tyrrhenus Mons, and embays the eastern flanks of the volcano. A large (~1000 km x 300 km) lava flow field, connected to the Tyrrhena Patera summit caldera complex via a volcano-tectonic rille, is superposed on the surrounding plains materials [16, 17]. Thus, the volcanic activity at Tyrrhenus Mons both pre-dates and post-dates the emplacement of at least some Hesperia Planum materials. To constrain and elucidate the relation between Hesperia Planum and Tyrrhenus Mons deposits, we are completing the geologic mapping of Mars Transverse Mercator (MTM) quadrangles -20257 and -15257 (Figure 3) at 1:500,000 [18]. These quadrangles are located to the west of the Tyrrhenus Mons summit, and contain the western boundary of Hesperia Planum as well. Mapping is almost completed for these quadrangles. Important discoveries as a result of geologic mapping include the extent of Tyrrhenus Mons eruptive materials, and the erosional morphology of these materials.

Hesperia Planum Materials: The region of Hesperia Planum located to the east of Tyrrhenus Mons (Fig. 2) is the typical “Hesperian ridged plains” [7, 9]. Aside from Tyrrhena Patera, no obvious volcanic vents

have been found within Hesperia Planum [cf. 4, 12, 17-20]. Lava flows can be seen at available image resolutions in the Tyrrhenus Mons lava flow field [17] that post-date the ridged plains, but they are not readily apparent within the ridged plains. In eastern Hesperia Planum, we have identified the following plains units: *highland knobby plains*, *smooth plains*, *highland smooth plains*, and *knobby plains*. Less than a dozen narrow (<100 m wide), linear to sinuous channels have been observed within Hesperia Planum (approximately 6 have been seen within the Tyrrhenus Mons MTM quadrangles -15257 and -20257). These channels have no obvious source or deposits associated with them, and regrettably High Resolution Imaging Science Experiment (HiRISE) images (25 cm/pixel) reveal that these channels are covered with secondary aeolian bedforms. Although their origin remains unclear, their morphology is most similar to terrestrial lava channels.

There are few obvious cross-cutting or superposition relations between the Hesperia Planum materials, and it is possible that the compositions of these units are similar, and the morphologic contrasts are caused by different styles and degrees of modification.

Within MTM quadrangles -15257 and -20257, Hesperia Planum materials can be further divided. In particular, northeast of Tyrrhenus Mons there is a “dark lobate plains” material that is best observed in THEMIS daytime infrared images. The lobate margins of these plains clearly overlie the lighter plains material to the west, and embay Tyrrhenus Mons edifice materials. The lobate margins of this unit show no shadows or bright cliffs, indicating a thin deposit. The deposit planform suggests that this material flowed from the north to the south, but we have not been able to identify a source. This material could be a thin lava flow or mudflow, and appears to be the youngest material within these MTM quadrangles.

Tyrrhenus Mons Materials: MTM quadrangles -15257 and -20257 were originally mapped by M. Farley, a M.S. candidate under Gregg’s advisement [18]. We are currently modifying her contacts, using images from the Context Imager (CTX) with resolutions of ~6 m/pixel to confirm or deny contacts originally identified on the basis of THEMIS visible and daytime infrared images.

Previous mapping efforts centered at the Tyrrhenus Mons summit [17] identified 2 units comprising the main edifice. Within MTM quadrangles -15257 and -20257, we have identified 2 additional units that are stratigraphically beneath those previously mapped (Fig. 3). These newly mapped units have a similar morphology to each other and to the previously mapped edifice units: they display stair-step erosional patterns; layers become thinner with distance from the

Tyrrhenus Mons summit; and the materials commonly occur as isolated mesas. Similar to the previously mapped Tyrrhenus Mons edifice units, we interpret these to be formed of pyroclastic deposits erupted from Tyrrhena Patera [cf. 19].

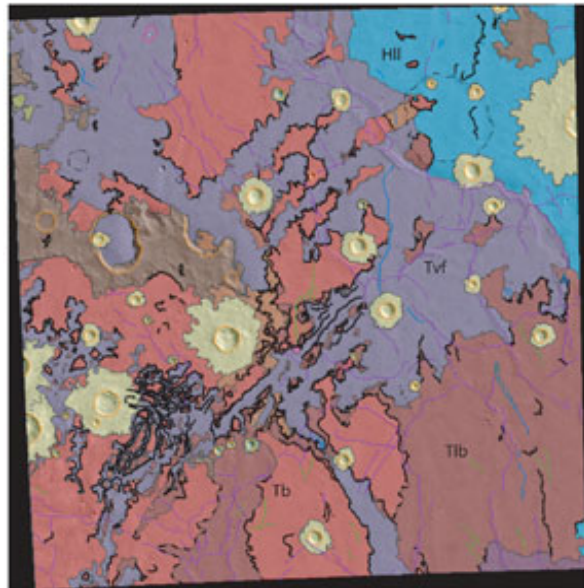


Figure 3. MTM Quadrangle -15257. Hll = Hesperian light lobate plains; Tvf = Tyrrhena valley fill; Tb = Tyrrhena basal edifice material; Tib = Tyrrhena lower basal edifice material.

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