GEOLOGIC MAPPING OF VOLCANIC AND SEDIMENTARY TERRAINS, NORTHEAST HELLAS, MARS. Scott C. Mest[1], David A. Crown[1], Joseph Michalski[2], Frank C. Chuang[1], Katherine Price Blount[3], and Leslie F. Bleamaster[4], [1]Planetary Science Institute, 1700 E. Ft. Lowell Rd., Suite 106, Tucson, AZ 85719; [2]University of Hong Kong, Hong Kong; [3]Texas A&M University-Commerce, Commerce, TX 75428; [4]Trinity University, San Antonio, TX, 78212. (mest@psi.edu)

Introduction: The eastern rim of Hellas and the surrounding highlands have been modified by numerous processes and provide a geologic record that spans most of the Martian time-scale [1-10]. Through geologic mapping and morphologic and spectral analyses, this investigation is exploring the geologic and hydrologic histories of the eastern rim of Hellas basin, where important spatial and temporal relationships between volcanic and volatile-driven processes are preserved (Fig. 1). This region displays a unique confluence of ancient rugged highlands, volcanic terrains of the Tyrrhenus Mons lava flow field and flanks of Hadriacus Mons, the canyons of Dao and Niger Valles, channelized plains, and geologically young volatile-rich mass wasting and mantling deposits.

Data and Methods: We use ArcGIS to compile image, topographic, and spectral datasets in order to map geologic units and features in the study region. This effort will produce a 1:1M-scale geologic map of MTM quadrangles -35262, -35267 and -35272 (Fig. 2), which will complete the geologic mapping of most of Hadriacus Mons and all of Dao and Niger Valles at 1M scale, providing a critical link to previously mapped adjacent quadrangles [9,11,12].

A THEMIS daytime thermal infrared (dTIR) brightness temperature mosaic (~100 m/pixel) is the primary mapping base. CTX images (~5 m/pixel) and THEMIS VIS (~18 m/pixel) multi-band images provide complementary spatial coverage and serve as context for high-resolution images. High-resolution HiRISE (<1 m/pixel) and MOC-NA (~1.5-12 m/pixel) images allow detailed analyses of mapped units and features. We use THEMIS dTIR images to distinguish between units with different thermophysical properties, and CRISM multispectral (~100-200 m/pixel) and hyperspectral (~18-36 m/pixel) data to map the occurrence and distribution of primary minerals and their alteration products within surficial materials. Crater size-frequency distribution statistics and stratigraphic relationships are used to determine relative ages.

Mapping Results: We are mapping features and geologic units that define four prominent terrain types within the map area (Fig. 2), including mantled highlands in the west and southeast, volcanic materials of the Tyrrhenus Mons flow field and the flank materials of Hadriacus Mons, and plains materials that cover large portions of the map area. Superposing these terrains are impact craters, many of which display lobate ejecta deposits. Mapping also shows that almost every surface in the map area has been modified to some degree by fluvial dissection ranging from small gullies within the highland terrains and along crater rims and valles walls, to single channels and valley networks incised within volcanic and plains materials.

Highland terrains: Highland terrains (previously mapped as Noachian-aged "mountainous material" and the "basin-rim unit" [e.g., 2,3,5-7]) are located in the southeastern and western parts of the map area. These areas consist of massifs and clusters of rounded knobs and rims of degraded impact craters that are surrounded by intermontane fill that appears smooth in THEMIS images. However, CTX images of these intermontane deposits show dissection by channels or coalescing debris aprons. On steeper slopes, massifs and knobs show evidence for viscous flow, or are dissected by narrow parallel gullies. Throughout the southeastern highland terrains, intermontane areas exhibit pitted, lineated or smooth surfaces. Most surfaces here, including adjacent plains, are coated with mid-latitude mantling deposits, which are being modified and/or removed in places via slope processes, deflation or erosion. Here, knobs are generally mapped at *mantled highlands* (unit mh) and intermontane areas are mapped as *lineated lobate material* (unit ll).

Tyrrhenus Mons flow field (unit TMff): We are refining the extents and locations of lava flow lobes, volcanic channels, erosional channels, and structures [13,14] within TMff. Flow lobes have sinuous planform shapes, and have elongate, broad, and digitate margins. Lobe margins range from subtle to well-defined, and variations are observed both within an individual flow and between different flows. Surface morphology and stratigraphic relationships observed in CTX images are used to evaluate sequences of flow emplacement. Some narrow channels observed in TMff display leveed margins and are associated with flow lobes; however, many channels in TMff lack these features and appear to be erosional [13,14]. Some erosional channels incised in TMff are narrow and indicate confined flow, whereas other channels are broad and braided and show evidence for extensive overland flow.

Hadriacus Mons flank material (unit Hmf): The southernmost extent of the flank materials occupies the north-central part of the map area. Previous studies have shown that these deposits consist of layered pyroclastic materials likely emplaced over multiple eruptive events [11,15-18]. Flank materials exhibit layering and are characterized by numerous broad valleys that radiate from the volcano's summit (north of map area). Most valleys are incised with narrow channels, but some broader valleys contain channels that are sinuous and braided. Wrinkle ridges are oriented parallel and perpendicular to the flank slopes, deform the flank materials, and occur as either broad ridges topped with a narrow crenulated ridge or just a narrow crenulated ridge [19].

Plains material (unit p): At THEMIS scales, plains exhibit mottled, relatively smooth surfaces dissected by channels and ridges. However, at CTX scales, it is apparent that plains units have undergone more significant surficial and structural modification. The plains are deformed by wrinkle ridges, dissected by fractures, and incised by channels with various morphologies. Areas within the plains have undergone collapse to form the canyon systems of Dao and Niger Valles. Other areas within the plains (some of which extend from the valles) contain fractures, scarps and elongated pits that define zones of subsided plains, large tilted slump blocks, and chaotic clusters of plains that may represent pre-valles morphology. It is likely that collapsed plains, combined with fluvial erosion, formed the valles [4]. Abundant evidence for fluvial erosion, including narrow sinuous channels, broad flat-floored canyons, and braided channels occur throughout the plains. Some broad channels emerge from areas of chaotic collapsed plains. In CTX, the plains exhibit surface textures that could result in subdivision of the plains into several facies. For example, plains around Dao and Niger Valles exhibit etched and knobby surfaces, whereas the plains south of Hadriacus Mons contain lobate, flow-like structures; some areas, such as in the southeast part of the map area, are mantled by the mid-latitude mantle material.

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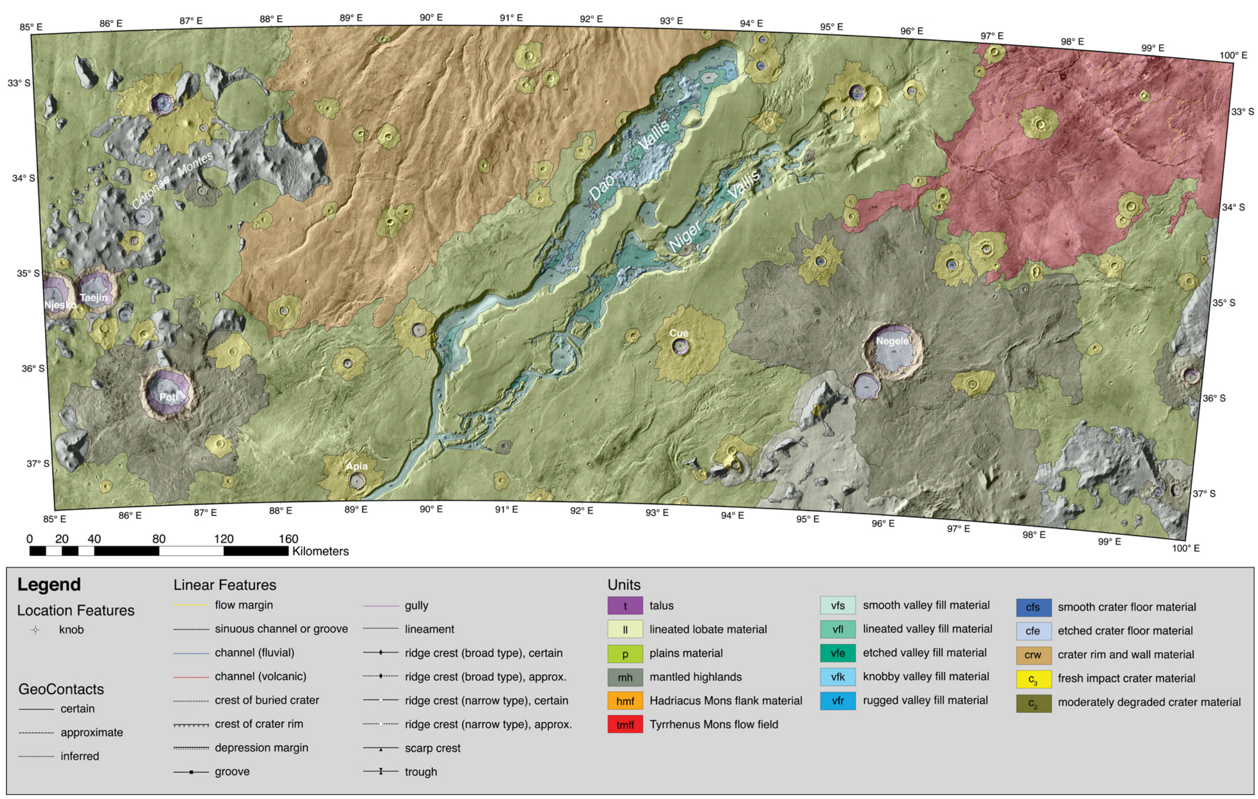

Figure 2. Geologic map of MTM quadrangles -35262, -35267 and -35272. Image base is THEMIS day IR mosaic (100 m/pixel).