GEOLOGIC MAPPING OF THE MAWRTH VALLIS REGION, MARS: MTM QUADRANGLES 25022, 25017, 25012, 20022, 20017, and 20012. F.C. Chuang[1] and L.F. Bleamaster III[1,2], [1]Planetary Science Institute, 1700 E. Fort Lowell Rd., Suite 106, Tucson, AZ 85719, [2]Trinity University Geosciences Dept., San Antonio, TX 78212 (e-mail: chuang@psi.edu).

Introduction: Mawrth Vallis is a 15-25 km wide, 500 km long sinuous channel that winds through the highlands of Arabia Terra and debouches into the lowlands of Acidalia Planitia. The Mawrth Vallis region lies along the gradational zone between southern hemisphere thick crust and northern hemisphere thin crust, a topographically distinct portion of the Martian crustal dichotomy. The origin and age of the dichotomy boundary are controversial [1 and cited references therein] and are further complicated by the multi-stage and multi-process geologic history [2,3] that has modified this ~6000 km section of the highland-lowland boundary (~15 N, 330E to ~30 N, 80 E; herein referred as the Arabia Terra boundary). Furthermore, the Arabia Terra boundary has been subjected to many post-boundary processes such as outflow floods to the west, volcanism and tectonism to the east, and potential volatile deposition and glacial modification to the north. This study seeks to better understand the history of the Mawrth Vallis region by mapping six MTM quadrangles (17.5-27.5 N, 335-350 E) at 1:1M scale using traditional and modern digital geologic mapping techniques [4,5].

Data and Methods: GIS-ready datasets include both Viking and THEMIS day IR basemaps, and 128 pixel/deg MOLA topographic data covering the entire mapping region. We will utilize ESRI ArcGIS software for all mapping work and storage (geodatabase). Our initial mapping will be focused on the units and structures seen in the THEMIS basemap. Refinement of unit contacts, identification of sub-units, and structural boundaries will follow using higher resolution data (e.g., HRSC, CTX, THEMIS VIS, MOC). OMEGA and CRISM data will be used to look for possible correlations between map units and various mineral signatures. Cumulative crater counts for crater-size frequency analyses will also be undertaken to obtain surface ages.

Phyllosilicate Materials: Since the initial discovery of phyllosilicate-bearing materials by the OMEGA instrument [6-7], Mawrth Vallis has been an area of intense study to map the stratigraphic sequence and diversity of clays in the region [8-16]. Three principle clay types are evident: Fe, Mg, and Al-rich smectites.

The Al-rich phyllosilicates, in the form of montmorillonite clays, are located in eroded light-toned outcrops along the flanks of Mawrth Vallis [6]. The Al-rich unit is minimally hundreds of meters thick [6,9,13], layered down to the meter-scale [6,7,9,10,13] with moderate thermal inertia signatures [9,13], and is eroded into knobby and flat mesa-like cliff forms [6,13]. In some locations along the walls of Mawrth Vallis, the Al-rich unit appears to lie stratigraphically between Fe or Mg-bearing smectite units (e.g., nontronite) [11,12]. A transitional unit with spectral signatures of both Al-bearing and Fe/Mg clays is also observed. The Al-bearing unit has meter-scale polygonally-fractured surfaces while the darker-toned Fe/Mg-bearing clay units have larger polygonal surfaces that are tens of meters wide [9,12]. These surfaces may have formed as a result of thermal and/or dessication contraction [9,12]. Other dark-toned materials present throughout the region are identified as pyroxene-rich materials (i.e., basaltic sand and dust) that mantle the surface (and clay-bearing units) [10,11,13].

The presence of clays in Mawrth Vallis is important as they imply a past aqueous environment in this region of Mars. It is argued that the clay-bearing units were formed early in the history of Mars (also prior to the formation of Mawrth Vallis) as aqueous deposits of sedimentary or pyroclastic materials, or a combination of both [6-13].

Mapping Results: The following describes the geologic units mapped thus far for the Mawrth Vallis region (Fig. 1).

Geologic Units

Highly-degraded crater material (c1) – Partial to discontinuous rim with little or no relief relative to surrounding surfaces; little to no ejecta blanket; several craters have channels along the interior walls. *Interpretation*: Deposits exhibiting extensive degradation that form ejecta, rims, and floors of impact craters.

Moderately-degraded crater material (c2) – Continuous rim with minor relief relative to surrounding surfaces and continuous to semi-continuous ejecta blanket; several craters have channels along the interior walls. *Interpretation*: Deposits exhibiting moderate degradation that form ejecta, rims, and floors of impact craters.

Well-preserved crater material (c3) – Pronounced, continuous rim with significant relief relative to surrounding surfaces and continuous ejecta blanket; several craters with ejecta blankets have rampart margins. *Interpretation*: Deposits exhibiting little degradation that form ejecta, rims, and floors of impact craters.

Ridged plains 1 material (pr1) – Plains with ridges ranging from straight to sinuous in planform shape with relatively constant widths that occasionally widen and narrow along their length; ridges appear as a simple step or a broad, flat-topped surface with relief; some ridge axes intersect at near right angles (i.e., near-perpendicular). *Interpretation*: Near-surface highland crust modified by tectonic forces producing ridges either by contraction and (or) upwards thrusting along a fault. For intersecting ridges, crustal shortening may have occurred as separate events along each ridge axis or as isotropic contraction activated structures of multiple orientations.

Ridged plains 2 material (pr2) – Smooth material with occasional ridges and abundant secondary craters and crater chains; areas near Mawrth Vallis appear etched where parts of the surface are stripped, exposing a possible lower surface unit. *Interpretation*: Highland crust modified from tectonic forces producing ridges, but in fewer numbers than Ridged Plains material 1. Eolian deflation and (or) weathering processes have eroded the surface, creating rough, knobby-like regions, particularly near Mawrth Vallis.

Acidalia plains material (ap) – Relatively smooth plains covering the lowlands beyond the dichotomy boundary; many locales have clusters or individual polygonal blocks and knobs of highland material; several ridges similar to those in Ridged Plains material are observed. *Interpretation*: Highland materials deposited into the low-lying northern plains by sedimentary processes that may include eolian, mass-wasting, and volcanic airfall deposits. Fluvially-deposited materials may be near the mouth of Mawrth Vallis.

Mawrth channel 1 material (mch1) – Multiple smooth surfaces within the channel floor along the upper and middle reaches of Mawrth Vallis; surfaces have a low abundance of impact craters, are divided into larger polygonal sections in places, and are sometimes incised by one or more channels; darker material is exposed from below this unit in the middle reaches. *Interpretation*: Fluvially-modified surface during the formation of Mawrth Vallis with possible remnant bars and scour features.

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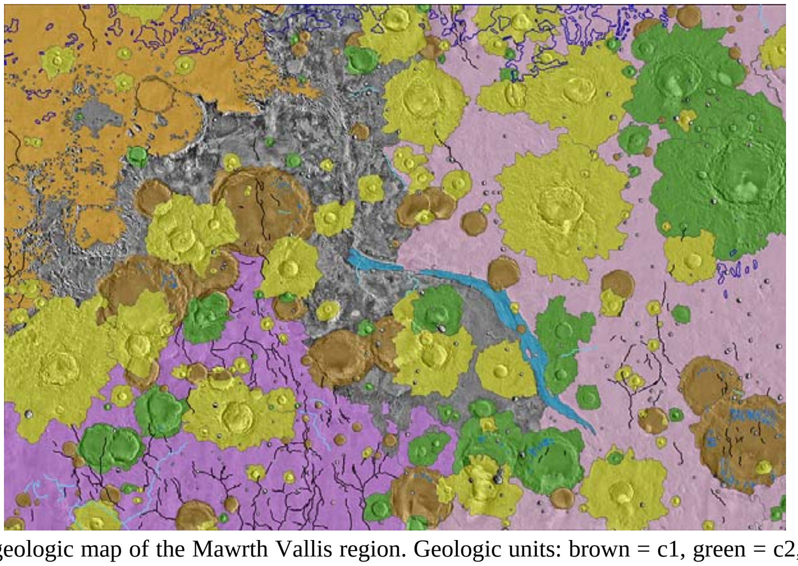

Figure 1. Preliminary geologic map of the Mawrth Vallis region. Geologic units: brown = c1, green = c2, yellow = c3, purple = pr1, pink = pr2, orange = ap, cyan = mch1. Geologic structures: thick black lines = ridge crests, dark blue areas = secondary crater fields/chains, thick cyan lines = sinuous channels, thin blue lines = fluvial channels.