GEOLOGIC MAPPING OF THE COPRATES CHASMA (MTM -15057), MARS: YEAR 2. M. Chojnacki[1], B. M. Hynek[2-3], S. R. Black[2-3], R. Hoover[2], and J. R. Martin[2]. [1]Lunar and Planetary Lab, University of Arizona, Tucson, AZ, 85721(chojan1@pirl.lpl.arizona.edu); [2]Laboratory for Atmospheric and Space Physics & [3]Dept. of Geological Sciences, University of Colorado-Boulder, Campus Box 600 UCB, Boulder, CO 80303.

Introduction: The eastern part of the Valles Marineris and Coprates chasma, is fundamentally important to our understanding of crustal formation and modification processes as there is more crust exposed here (>11 km) than perhaps anywhere on Mars [1–3]. These exposures are relatively unobscured, partially due to the lack of interior layered deposits that elsewhere mask wall contacts. Coprates chasma has only been mapped as part of a regional and global mapping efforts (at coarse 1:2M and 1:20M scales) [4, 5]. The primary objective of this 2013 PGG-funded study is to produce a geologic map of the Coprates chasma quadrangle (MTM-15057) at the 1:500,000-scale that will be submitted for peer-review and publication by the USGS.

Preliminary investigation into the Coprates chasma area has found a rich diversity of mineralogy. High-resolution spectral observations of Coprates chasma wall, landslide, and dune units show several classes of mafic- and phyllosilicate-bearing surfaces [6–8]. The discovery of a distinct class of alteration products, known as "deep phyllosilicates", found within the canyon wall stratigraphy motivates greater investigation into their lateral and vertical extent in the Valles Marineris. More recently, the intriguing phenomena of recurring slope lineae (RSL) have been detected in the map area [9] and attest to the importance of local geology. Through detailed geologic mapping, we expect to decipher the geologic, tectonic, aeolian, and aqueous histories of this key region of Mars.

Datasets: A 6 m/pix visible wavelength CTX mosaic was used for the basemap. We supplement with 100 m/pix daytime and nighttime IR data from THEMIS for morphology and thermophysical properties, respectively. HiRISE coverage (25 cm/pix) exists for roughly 12% of the map region and eight HiRISE DTMs (1m/pix) are located in key locales. Gridded MOLA elevation data (~500 m/pix) and an HRSC stereo-derived DTM (50 m/pix) provide additional topographic information. Finally, CRISM hyper- and multi-spectral cubes were consulted for compositional information.

Preliminary Work: To date, we have drafted a preliminary 1:500,000-scale geologic map of the entire study area excluding the wall materials (**Fig. 1**). Initial mapping of canyon walls has commenced with the construction of more than a dozen HiRISE-based stratigraphic columns. In these, we find a laterally continuous sequence except for in the south central portion where the wall rock shows a different character, which we interpret as the manifestation of the ancient Coprates Rise mountain range intersecting the canyon from the south. Additionally, we have initiated two of three planned 1:25,000-scale region of interest maps to discern the finer-scale details of stratigraphic relationships within the map area (**Fig. 1**). These sub-area maps provide fine scale details of key areas that can then be applied to the larger map region. One fine scale map was drafted in the southcentral-portion of the Coprates chasma where significant alteration minerals are present [10]. The other includes a catena (tectonic depression) that shows strong evidence of a paleolacustrine environment described in *Martin et al.* [11].

Plateau Units: Our plateau units above the canyon rim are fairly consistent with unit boundaries defined by *Tanaka et al.* [5] in the recent global map. These include numerous Middle Noachian through Early Hesperian units (Fig. 1). The oldest terrain occurs in the southwest/southcentral area of the map and includes a portion of an ancient volcanic edifice and degraded and structurally-deformed highlands. These are superposed by Late Noachian highlands exhibiting terrain of mottled albedo and varied topography. In places, fluviolacustrine processes have modified this surface. Within this unit is a light toned marker bed pocked with small craters and in places, this unit shows phyllosilicate signatures in CRISM data [*C. Weitz, pers. comm.*]. The youngest plateau units are smooth, lightly cratered terrains and are interpreted as Hesperian-aged lava flows. Most of the plateau units have been modified with wrinkle ridges, and a few larger craters, which sometimes show multilobate ejecta.

Canyon Interior Units: Mapping of the interior has revealed a diversity of units not resolved by previous efforts at coarser scales. The 14 floor units encapsulated in Fig. 1 include: (1) *rough canyon floors* with hummocky textures and a sparse crater distribution (> 1 km diameter); (2) *smooth canyon floors* with fractures, polygonal terrain, often heavily cratered; (3) *rough mounds or blocks,* possessing spurs, talus, and occasional fine-layering; (4) *flat floor mounds* with a smooth table-like morphology; (5) *crater and ejecta materials*; (6) *crater interior deposits* consisting of hummocky materials; (7) *volcanic edifices* with small cone like structures; (8)

layered deposits which are light in tone, patchy, and distributed on canyon floors and walls; (9) *landslide deposits* of rugged, sometimes lineated materials and varying runout distances; (10) *aeolian dune deposits* of low-albedo sand forming slip faces and masking lower-lying units; (11) *aeolian sand sheets* of mid-toned fine materials without prominent duneforms; (12) *mantling units* of dark-toned, relatively thick (>5 m) flat deposits that retain small craters; (13) *blocky deposits* of concentrated, small (<500 m) blocks or mounds; (14) a surficial unit of a low-albedo, smooth *mantle material* that covers some geologic units, but does not obscure morphology.

Mapping thus far has revealed diverse and complex relationships amongst geologic units. Two classes of floor mounds are evident; some possessing horizontal layering and representing sedimentary units that were presumably more extensive in the past and others with spur-and-gully morphology akin to wall rock. A separate class of sedimentary units with fine layering and high albedo are present in topographic lows in the southwestern portion of the floor and maybe indicative of past aqueous processes. Relatively well-preserved, small volcanic edifices are scattered on the canyon floor and maybe signatures of Amazonian-aged mud volcanism [12]. Likewise, dark-toned, indurated mantling materials superpose many units in canyon interior and their morphology suggests a geologically recent pyroclastic origin. Variable-age landslides and smaller fans cover many floor locations and attest to the canyon's long history of mass-wasting. Finally, numerous RSL or potential salty water seeps are located among central wall units and our ongoing analysis will attempt to correlate their occurrences with lithologic map units. In summary, the detailed mapping is revealing a long and complex history for the formation and evolution of the Coprates chasma.

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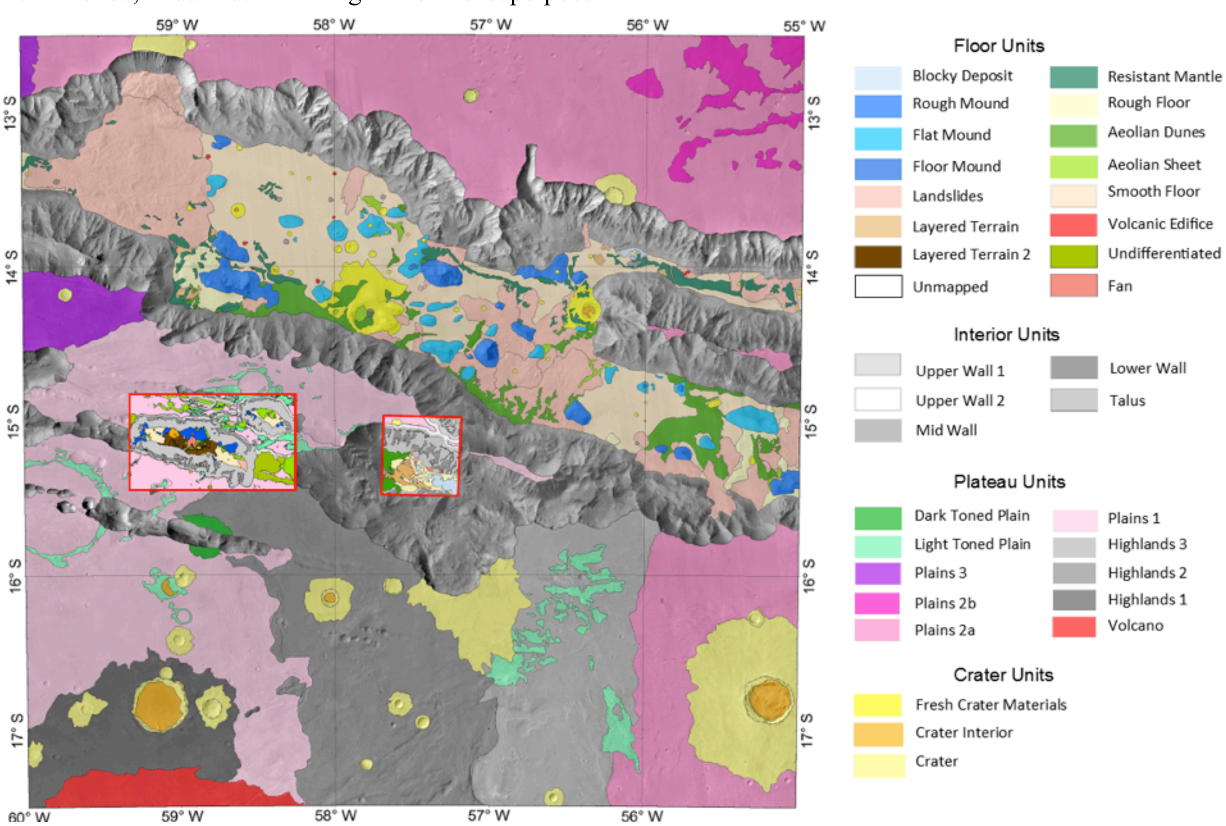

Figure 1. Geologic units of Coprates chasma MTM -15057. Two 1:25,000-scale region of interest maps are indicated with red boxes (see [10-11]).