GEOLOGIC MAP OF SOUTHWESTERN MELAS CHASMA, MARS, 1:150,000-SCALE. C. M. Fortezzo, L. A. Edgar, and S. R. Black, U.S. Geological Survey Astrogeology Science Center, Flagstaff, Arizona, cfortezzo@usgs.gov.

Introduction: Sedimentary basins on Mars provide an important record of past aqueous and atmospheric processes, and some of the thickest and most diverse exposures of sedimentary rocks occur within the Valles Marineris canyon system [1-7]. Though the Valles Marineris system has been studied with a variety of datasets over the past several decades, modern datasets provide a renewed look into these deposits and their spatial and temporal relationships. The Valles Marineris system contains several smaller sub-basins which provide insight into the tectonic, depositional and erosional processes that have occurred throughout the canyon, e.g. [5-9].

Here we focus on the informally named Melas basin, located in southwestern Melas Chasma in central Valles Marineris, which is defined as a ~34 km long enclosed basin and contains geologic units, landforms, and hydrated minerals that are indicative of punctuated episodes of aqueous activity spanning from the Hesperian to Early Amazonian [10-12]. Understanding the dominant processes that led to the accumulation of these rocks and the tectonic environment that provided the accommodation space for their deposition is critical to understanding the evolution of Valles Marineris.

Geologic Setting and Background: Melas basin preserves an extensive history of tectonic, mass-wasting, and aqueous processes. Rocks that outcrop within Melas basin are predominantly stratified and are interpreted to have been emplaced during or after the Early Hesperian [4, 13, 14]. Precipitation fed valley networks are identified on the plateau margins of Melas basin [10, 15]. The closed basin follows elevation contours at -1800 m [10], -2085 m and -2250 m [12] suggesting that there may have been up to three episodes in which a standing body of water was present in Melas basin during the Late Hesperian. Light-toned, laterally extensive layers are exposed in the center of the basin (Figure 1), some of which show clinoform geometries that have been interpreted as either a channel-levee complex or a delta complex [16].

Flat multi-lobe fans are exposed on the western side of the basin which have been interpreted as a deep subaqueous depositional fan system based on channel properties and comparison with terrestrial fans [17]. The Melas basin hosts a variety of fans that have been interpreted to be deposited in a range of systems including deep subaqueous, shallow subaqueous and subaerial environments, which points to fluctuations in lake level over centuries to several millennia [12].

Datasets and Methods: This investigation focuses on the production of a 1:150,000-scale regional geologic map of the Melas basin and surrounding terrain. The regional mapping scale was chosen to complement the existing detailed mapping of a portion of the Melas basin [18-19] and because it affords important contextual examination of geologic relationships. The mapping is based on a Mars Reconnaissance Orbiter Context Camera (CTX) mosaic (~6 m/pix).

The study region covers an area between lat -75.5 and -77.5 E. and long -8.9 and -10.4 N (Fig. 1). To produce a 1:150,000-scale regional geologic map, we are using a digital mapping scale of 1:50,000 and a vertex spacing of 50 m.

Results: The resulting geologic units are subdivided into four groups: Plateau, Melas Basin, Melas Chasma, and Widespread.

The Plateau group includes the plateau surface materials, undivided wall rocks, and displaced blocks of plateau materials. The plateau surface materials form a nearly horizontal surface interrupted by undulations caused by tectonics and preserved as linear to curvilinear fault traces. Stratigraphically below the plateau surface are the stratified to massive undivided wall rocks that outcrop in the scarp walls. Lastly, blocks of displaced plateau materials form wedges and elevated surfaces within the subbasin. These materials have a similar stratified to massive appearance as the undivided wall rock, where exposed, and a similar flat surface with preserved fault traces as the plateau surface unit.

The Melas Basin group includes a bright floor deposit, valley floor and fan sediment deposits, five stratified units, contorted materials, and a unique slope deposit. The bright floor deposit appears to fill in local lows and overly low relief topography. The surface of this unit is undulating or corrugated, where unaltered by erosional processes. The valley floor and fan deposits are mostly fine-grained debris transported through the valley and deposited in fans at their mouths. The stratified deposits (Figure 1) are subdivided by their relative elevation and occurrence around and within the enclosed basin discussed above. Capping a northern section of stratified deposits is a layer of contorted circular to semicircular, banded materials (Figure 1). These occur both in Melas basin and Melas Chasma. It is unclear whether these represent the same deposit or different deposits with a similar depositional process. Finally, a smooth, relatively high brightness material is

plastered on the slopes of the horst separating Melas basin from Melas Chasma (Figure 2).

The Melas Chasma Group includes a chasma floor deposit, contorted materials, and the Melas Mensa stratified deposits, and a high relative brightness unit. The chasma floor deposit is a bright, mostly flat lying deposit exposed on the floor of the chasma, but mostly obscured by a mantle of eolian materials. The chasma contorted materials consist of tightly packed, quasi-circular, banded blocks of materials. These materials extend from the mouth of Ius Chasma, onto the floor of Melas Chasma, and along the northern base of the horst ridge separating Melas Chasma and Melas basin. The Melas Mensa unit forms a topographic mesa within Melas Chasma. The unit is stratified to massive and is generally bright, but subdued by eolian mantles.

The Widespread Group include a talus/mass wasting unit forming the slopes along the margins of the basin and chasma, impact craters and their ejecta, and eolian deposits.

Work on this mapping effort is ongoing, and we expect to submit the map for review by the Annual Planetary Geologic Mappers Meeting.

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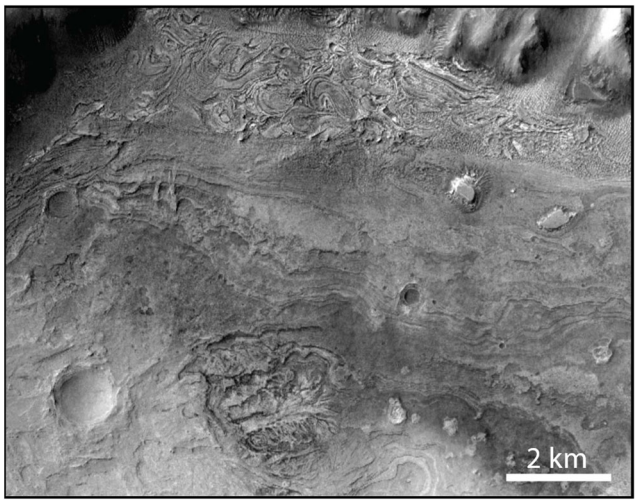

Figure 1. Melas basin stratified deposits within the enclosed subbasin. The contorted bedding near the top of the image is the highest stratigraphic exposure in the area. Lowest elevation is near center bottom of the image. Portion of CTX mosaic.

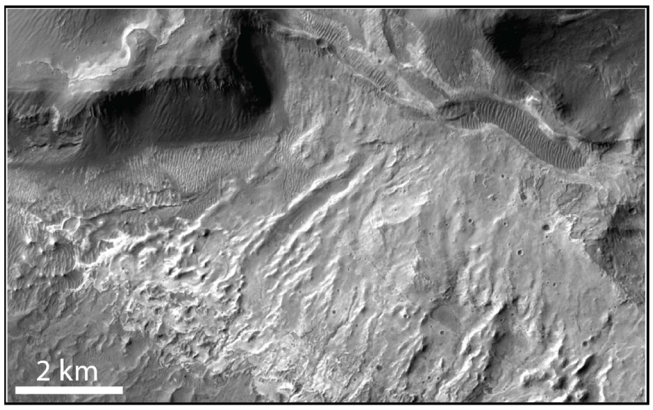

Figure 2. Slopes of the ridge separating Melas basin from Melas Chasma. Relatively brighter material appears to be pasted onto the existing topography. Note top left corner where material appears to conform to the slight doming of the topography giving this deposit a pasted on or glazed appearance. Portion of CTX mosaic.