HYDRATED MINERALS AND FLUVIAL FEATURES IN AND AROUND THE MELAS CHASMA BASIN. C. M. Weitz, R. Williams, E. Noe Dobrea, and A. Baldridge, Planetary Science Institute, 1700 E fort Lowell, Suite 106, Tucson, AZ 85719 (weitz@psi.edu).

Introduction: Using a synergy of mineralogy derived from CRISM data and morphology interpreted from HiRISE and CTX images, we map geologic units within and around the Melas basin (Fig. 1). The Melas basin, located along the wallrock in southwestern Melas Chasma, contains layered beds in a postulated paleolake [1,2]. In the western portion of the basin are extensive Hesperian-aged valley networks. Alluvial fans, folded beds, sulfate deposits, and depositional fans [3] are also found within the basin. Along the northern basin wallrock and chasma floor are unusual draping deposits, blocky deposits and light-toned layered rocks [4]. All these diverse units imply a complex aqueous history for the region.

Results*:* Here we summarize some of the major findings of our data analysis and mapping.

Layered Sulfates on the Melas Chasma Floor: Using CRISM data, we have identified numerous sulfate units along the floor concentrated adjacent to wallrock that defines the basin (Fig. 1). The units are either polydrated sulfates (PHS) or monohydrated sulfates (i.e., kieserite). The sulfates appear mixed in many exposures, producing a banded appearance. While much of the chasma floor is covered by eolian ripples and debris, small outcrops of bedrock are visible and likely to be additional sulfates.

Draping Unit: A draping unit occurs along much of the northernwestern wallrock that defines the basin (Fig. 1). This draping unit is relatively bright, thin, and smooth. Using several HiRISE-derived DTMs (Fig. 2), we measured a thickness of about 1-5 m consisting of 1-3 beds for the draping unit. Erosion has removed the unit along hilltop peaks but outcrops are visible along lower flanks and in topographic lows between the hills, including within valleys. Closer towards the chasma floor, the unit has been partially buried beneath blocky deposit BD1.

CRISM spectra of this material show an absorption at 1.93 μm and either a broad absorption between 2.20-2.28 μm, consistent with a hydrated silicate, or a doublet absorption at 2.20-2.21 and 2.26-2.28 μm. Similar doublets have also been identified in Ius Chasma [5], Capri Chasma [6], and Mawrth Vallis [7] and interpreted to be a leached clay based upon laboratory spectra fitting this doublet. Because the unit shows spectra that exhibit both a broad absorption and a doublet between 2.20-2.28 μm, there could be an altered or partially dehydrated opaline silica [3,8] or possibly another phase mixed with opal, such as gypsum.

Layered Unit with Valleys: To the east and west of the paleolake is a layered unit incised by valleys. In the west, the layered unit and valleys are covered by the bright draping unit. The layered unit appears spectrally bland in CRISM data, which means the mineralogy is unknown. The unit is the likely source of much of the material that now comprises the layered beds within the paleolake basin.

Blocky Deposits: Three blocky deposits (BD) have been identified along the chasma floor and within the basin (Fig. 1). Materials contained in the largest blocky deposit, BD1, are similar in spectra and morphology to units found upslope along the wallrock, supporting previous interpretations that the blocky deposit represents mass wasting materials [4,9]. There are multiple rock types within the blocky deposit, some that experienced ductile deformation and other rocks that show brittle deformation. Brighter rounded blocks are typically contained within a darker matrix (Fig. 2).

CRISM spectra are consistent with PHS for most of the bright blocks in a spectrally bland darker matrix. Sometimes the blocks exhibit the broad 2.20-2.28 μm absorption or the 2.20-2.21 and 2.26-2.28 μm doublet characteristic of the draping unit. Other blocks have an additional feature at 2.28 μm, perhaps indicating a Fe/Mg-smectite. If smectite is present in the blocky deposit, it could result from incorporation of altered wallrock material during mass wasting down the wallrock and on to the chasma floor. Finally, two small blocks have absorptions at 1.43, 1.77, 1.92, 2.23, and 2.28 μm, suggesting the presence of gypsum.

Fluvial Features within the Paleolake: Nine fan-shaped landforms have been identified within the paleolake and we group them into six classes suggesting different depositional environments. Importantly, some of these fans are consistent with shallow emplacement and serve as paleolake level indicators. Superposition relationships indicate discrete temporal windows for individual fan formation and support the hypothesis that the paleolake that once occupied the basin was long-lived [2]. In addition, new details of the western valley networks have been observed revealing multiple flows that superpose the large scale valley networks mapped by [2]. These cross-cutting relationships among the valley networks indicate that all fluvial events were not coeval.

Although HiRISE images show distinct light- and dark-toned beds within the paleolake, CRISM spectra do not show any absorption features associated with these sediments, other than jarosite in clinoforms [3] and hydrated silica interpreted to be an opal that is found in association with a few small bright mounds in the western portion of the basin [3] (Fig. 1).

References: [1] Mangold et al. (2004) *Science*, *305*, 78-81. [2] Quantin et al. (2005) *JGR*, *110*, E12S19. [3] Metz et al. (2009) *JGR*, 114, doi:10.1029/2009JE003365. [4] Weitz et al. (2003) *JGR* 108, doi:10.1029/2002JE002022. [5] Roach et al. (2010) *Icarus* 206, 253-268. [6] Weitz et al. (2012) *JGR* submitted. [7] Noe Dobrea et al. (2011) *Mars Journal*, 6, doi:10.1555/mars.2011.0003. [8] Milliken et al. (2008) *Geology* 36, 847-850. [9] Metz et al. (2010) *JGR* 115, doi:10.1029/2010JE003593.

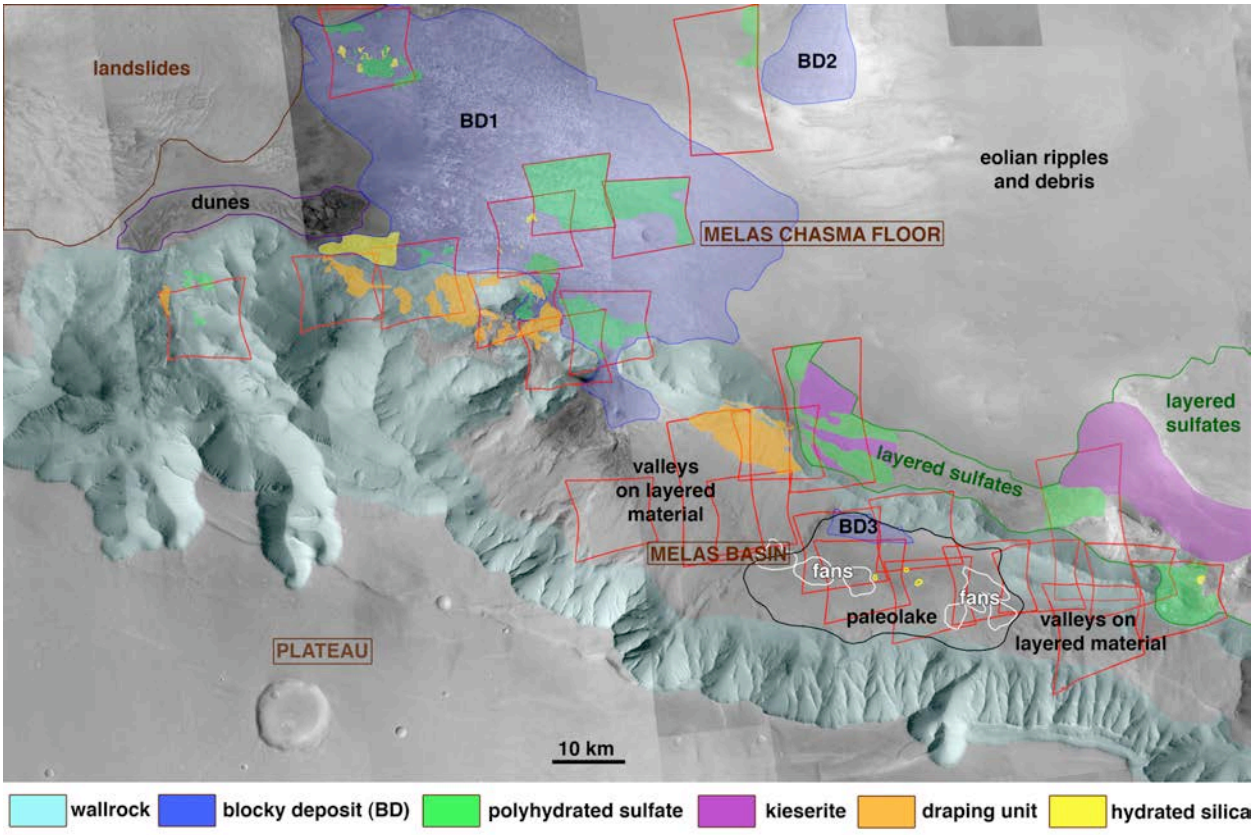

Figure 1. Geologic map illustrating major geologic units identified in the study region. Where CRISM images exist (red outlines), minerals have been mapped in association with units. The paleolake represents the inferred lacustrine basin identified by [2]. This mosaic consists of CTX images overlain on a THEMIS daytime IR basemap.

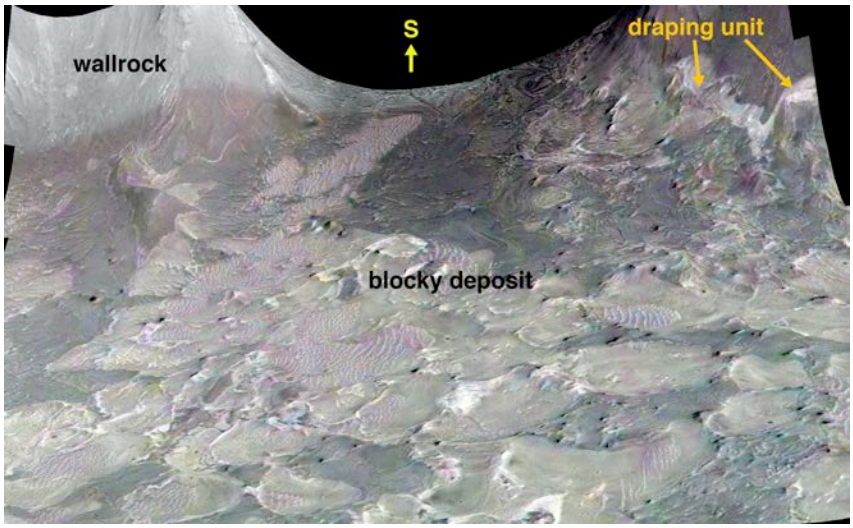

Figure 2. HiRISE DEM at 5x vertical exaggeration illustrating blocky deposit extending upslope from the chasma floor through an opening between wallrock hills. Colors are from CRISM spectral parameters (R=Olivine Index, G=BD1900R, B=BD2500). Brighter blocks within the blocky deposit are consistent with polyhydrated sulfates (light green) while the darker matrix that contains these blocks is spectrally bland. An exposure of the draping unit is also shown along the wallrock. Image is about 5 km across.