GEOLOGIC MAPPING AND SPECTRAL ANALYSIS OF GORGONUM BASIN, MARS. C. M. Weitz[1], E. Z. Noe Dobrea[1], and D. C. Berman[1], [1]Planetary Science Institute, 1700 E Fort Lowell, Suite 106, Tucson, AZ 85719 (weitz@psi.edu).

Introduction: Eridania basin is thought to have once supported an ancient lake within the Terra Sirenum region of Mars [1,2]. After drainage through Ma'adim Vallis, the Eridania paleolake was later subdivided into smaller, isolated lakes, including within our study region of Gorgonum basin [1,2]. Previous studies of Gorgonum basin have postulated that an ice-covered lake may have once existed here [3]. In order to explore and evaluate the sediments and alteration minerals that formed within this postulated lake, we have performed a detailed investigation and geologic mapping of the Gorgonum basin region.

Our study region (Fig. 1) extends from 33.5° to 41.5°S latitude, and 185.8 to 196.8°E longitude. Mapping was performed in ArcGIS using a THEMIS daytime infrared mosaic as the basemap. CTX coverage across the region is nearly complete and was utilized for some mapping, especially at geologic boundaries and where THEMIS coverage was noisy or missing. CRISM data was also analyzed for locations with hydrated minerals. Finally, HiRISE images were studied to explore morphologic details about each geologic unit.

Geologic Units: We identified and mapped 15 geologic units. These include three highland units (Hr, Hm, and Hs), four plains units (Pr, Ps, Pf, and Pe), two chaos units (Ch1 and Ch2), two basin fill units (Bf1 and Bf2), fresh craters (C), dunes (D), Electris deposits (El), and crater fill (Cf). The highland units were divided based upon their appearance into: rugged terrain with steep slopes (Hr), moderately modified highlands with hilly terrain (Hm), and smooth highlands (Hs). Similarly, the plains were separated based upon their appearance into: smooth plains (Ps), rough plains (Pr), fractured plains (Pf), and etched plains (Pe). The fractured plains, Pf, consist of smooth plains that have been dissected into larger km-sized blocks by extensive fracturing within Gorgonum basin. Rough plains, Pr, surround the chaos terrain at the center of Gorgonum basin and appear to have eroded into a rougher surface. Etched plains, Pe, are exposed by erosion of overlying smooth plains, Ps, and contain inverted channels and light-toned deposits (Fig. 2).

Gorgonum chaos consists of meter to km-sized knobs and was mapped as either larger smooth knobs, sometimes appearing light-toned (Ch1), or smaller and rougher knobs (Ch2). Within the chaos terrain is a smooth and flat fill that occurs at lower elevations within the center of the basin (Bf1) or stratigraphically higher that embays the chaos knobs (Bf2). The Electris unit has been previously described [4] as a finely layered deposit with steep escarpments and smooth upper surfaces. Many of our geologic units are similar to those mapped to the west in Eridania by [5].

CRISM spectral analysis: We analyzed CRISM data within our study region to search for hydrated minerals. Previous studies have shown that Fe/Mg-phyllosilicates are common in Terra Sirenum [6-9] and more recently Al-phyllosilicates have been identified [5,9]. We also found both Fe/Mg-smecites and Al-phyllosilicates within our Gorgonum mapping region. Al-phyllosilicates within unit Pe appear brighter and occur stratigraphically above Fe/Mg-smecites (Fig. 3). Where unit Ps is being eroded, unit Pe is exposed to reveal the clays. Our interpretation is that the clays formed by aqueous alteration in unit Pe before subsequently being buried by unit Ps. Fluvial valleys that change from depressed to inverted going from Ps to Pe indicate younger water activity occurred in the basin, followed by erosion (Fig. 2).

Additional Fe/Mg-smecites and Al-phyllosilicates were identified within the light-toned chaos material, unit Ch1, and the upper walls of a Sirenum Fossae graben that dissects through Ch1. Al-phyllosilicates occur along the higher elevations of the chaos knobs whereas Fe/Mg-smecites are observed in the upper walls of a graben that cuts through the knobs (Fig. 4). Fe/Mg-smecites, but no Al-phyllosilicates, were identified by [5] in similar light-toned chaos knobs within Eridania basins to the west.

Future work: Crater counting and stratigraphic analyses will next be conducted to determine unit ages and to assess the geologic history of the region, especially the aqueous activity associated with possible lacustrine conditions.

References: [1] Irwin R.P. et al. (2002) *Science 296*, 2209-2212; [2] Irwin R.P. et al. (2004) *J. Geophys. Res. 109*, *E12009*, doi:10.1029/2004JE002287. [3] Howard A.D. and J.M. Moore (2004) *Geophys. Res. Lett., 31*, L01702, doi:10.1029/2003GL018925. [4] Grant J.A. et al. (2010) *Icarus 205* (1), 53-63, 10.1016/j.icarus.2009.04.009. [5] Adeli S. et al. (2015) *J. Geophys. Res. Planets, 120*, doi:10.1002/2015JE004898. [6] Glotch T.D. et al. (2010) *Geophys. Res. Lett., 37*, L16202, doi:10.1029/2010GL044557. [7] Annex A.M. and A.D. Howard (2011) LPSC 42, Abstract 1577. [8] Ruesch O. et al. (2012) *J. Geophys. Res., 117*, E00J13, doi:10.1029/2012JE004108. [9] Wendt L. et al. (2013) *Icarus, 225*, 200–215.

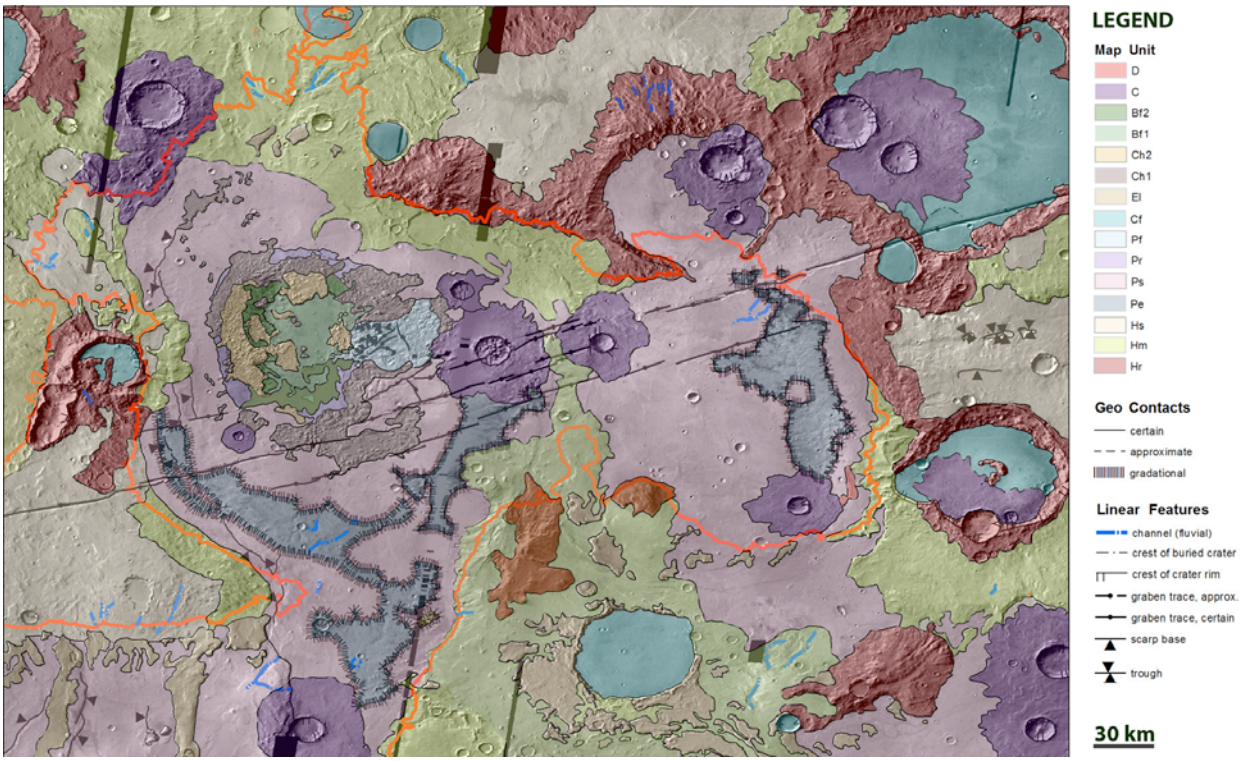

Figure 1. Geologic map of Gorgonum basin. The orange line represents the MOLA 1100 m Eridania shoreline [1].

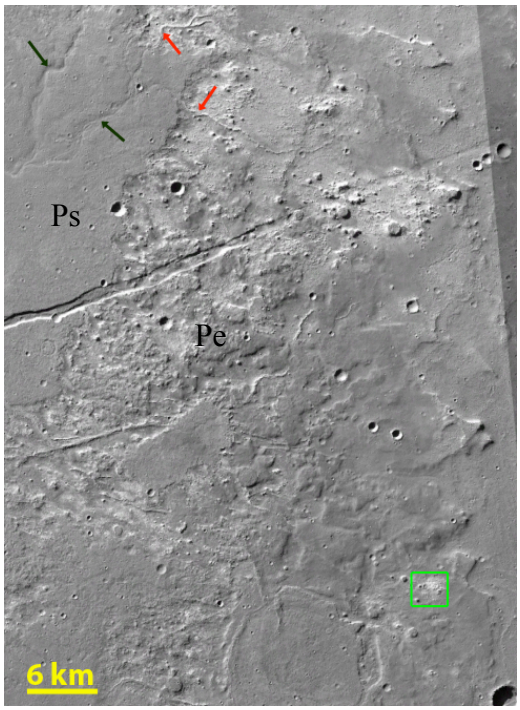

Figure 2. Example of etched plains (Pe) that underlies smooth plains (Ps). In unit Ps, valleys are depressions (black arrows) whereas in unit Pe the valleys become inverted (red arrows). Green box indicates location of Fig. 3.

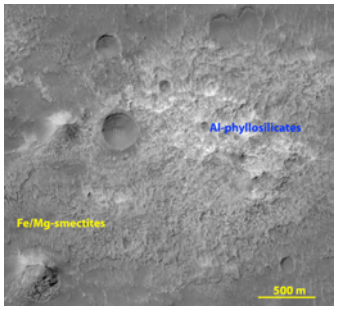

Figure 3. Both Al-phyllosilicates and Fe/Mg-smectites occur within unit Pe. The Al-phyllosilicates appear brighter and higher in stratigraphy relative to the Fe/Mg-smectites.

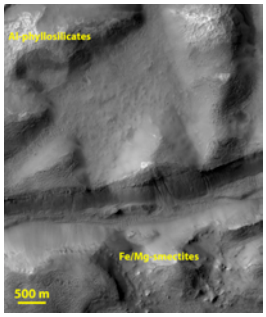

Figure 4. Both Al-phyllosilicates and Fe/Mg-smectites occur within the light-toned knobs of unit Ch1.