PAST WATER ACTIVITY IN ARIADNES COLLES ON MARS.

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Introduction: Mars exhibits numerous 'chaotic terrains' typied by a jumble of mesas and knobs of varying sizes, probably formed by collapse [1]. Ariadnes Colles, one of these chaotic terrains, is located in the southern highlands of Mars, in a circular depression with a maximum diameter of about 240 km,at about 34° south and 172° east. It covers an area of about 180 x 160 square km [2 , 3].

Methods: We analyzed the topography, stratigraphy, morphology and mineralogy using MOLA, HRSC, CTX, MOC and HiRISE imagery together with hyperspectral data from CRISM.

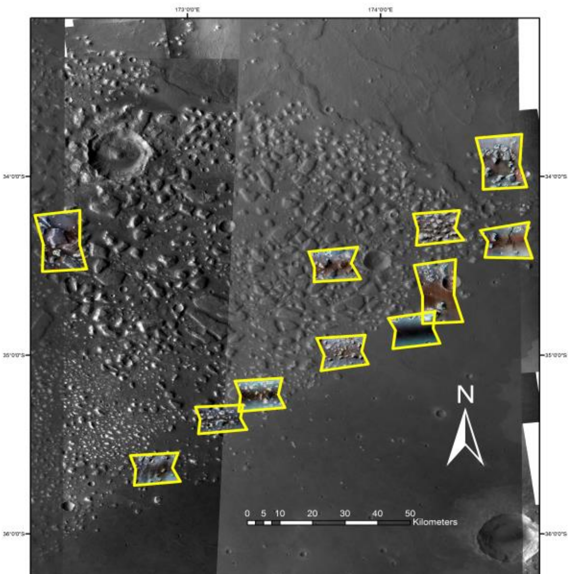

Figure 1. Map of Ariadnes Colles on CTX with the locations of the CRISM used for this work.

The CRISM hyperspectral data have been used in order to identify the mineralogical composition of light-toned knobs. The CRISM data have been atmospherically and photometrically corrected with the CAT tool v7.0 under the ENVI software. We produced maps of absorption band depth to identify and localize the spectra with the diagnostic signatures of phyllosilicates and sulfates [4].
These selected spectra have been ratioed by neutral spectra extracted from the same data cubes in order to reduce noise and emphasize the absorption bands in the spectra.

Spectral Results: In Ariadnes colles we identify different Region of Interests indicating the following mineralogical settings:

- Yellow ROI (Bright pixels in gray scale D2300) are Fe-Mg rich Phyllosilicates which show range spectral feature from 2.28 to 2.31 typical of Smectite group, in particular Nontronite (more rich in Iron) and Saponite (more rich in Magnesium);
- Black ROI (Bright pixels in gray scale BD2210) are Al-OH rich Phyllosilicates which show spectral feature of 2.20 typical of Montmorillonite;
- Green ROI (Bright pixels in gray scale SINDEX) are Sulfates which show spectral feature typical of 2.26 like the Jarosite.

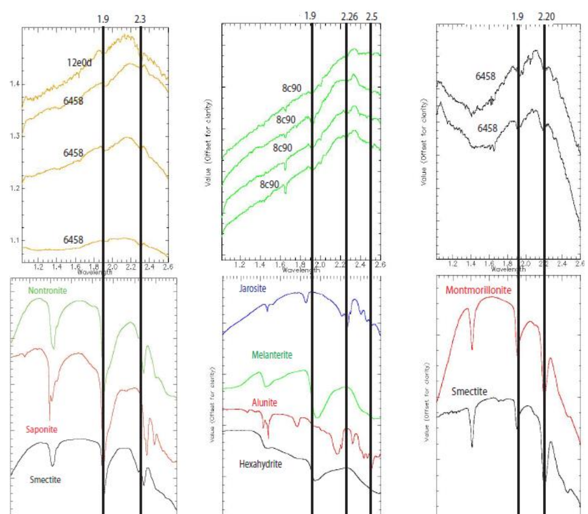

Figure 2. Plot showing CRISM spectra compared to laboratory spectra of selected minerals.

Observations on the morphology and the mineralogy: The floor is characterized by mesas and knobs that are about 1 to 10 km, generally larger in the central than in the outer part of the chaos. The knobs and mesas typically contain light-toned materials that display different textures. Both phyllosilicates and sulfates are recognized in the light toned materials indicating formation in both a water-rich environment and an evaporative environment. The light-toned materials are often covered around the knobs by a darker rubbly layer interpreted to be lava flows. These morphologies could be the remainder of previously more extended materials, which are more resistant to erosion probably due to a process of cementation by fluid circulation and/or a more resistant capping layer. The presence of dendritic valley networks near the rims of the basin, that run towards its center (for example near 173°E - 38°N) and which confirm past water activity and suggest Ariadnes may have probably hosted a lake.

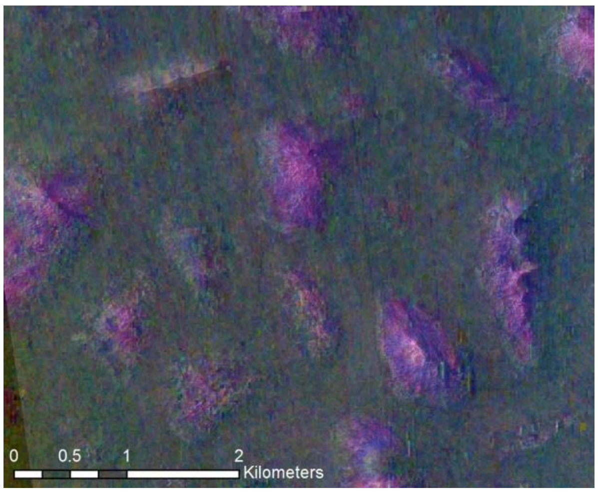

Figure 3. Portion of HiRISE with spread over the HYD band combination. Magenta pixels highlight the Sulfates and Blue pixels the Phyllosilicates.

Conclusions: The floor is characterized by mesas and knobs that are about 1 to 10 km, generally larger in the central than in the outer part of the chaos.

These knobs - mesas typically contain phyllosilicates and sulfates.

Probably these minerals formed during two different episodes:

- the Sulfates are related to a strong evaporation/infiltration of the water;
- the Phyllosilicates are related to an hydrotermal volcanic process.

References: [1] Sharp, R.P. (1973). J. Geophys Res., 78, 4073-4083. [2] Golder, K.B. and Gilmore, M.S. (2012a). LPSC XLIII, Abstract #2661. [3] Irwin, R.P.III, Howard, A.D., Maxwell, T.A. (2004). J. Geophys Res., 109 (E12), E12009. [4] Pelkey, S.M., et al.: J. Geophys. Res., 112, E08S14, 2007.