MORPHOLOGICAL AND SPECTRAL EVIDENCE FOR PHYLLOSILICATE-RICH LAYERS AND MAJOR GEOLOGICAL DISCONTINUITIES IN THE WALLS OF VALLES MARINERIS, MARS. J. Flahaut[1], J. F. Mustard[2], C. Quantin[1], H. Clenet[1], P. Allemand[1], P. Thomas[1], G. Dromart[1] and L. H. Roach[2]. [1]Laboratoire de Science de la Terre, UMR CNRS 5570, Université Claude Bernard/Ecole Normale Supérieure de Lyon, 2 rue Raphaël Dubois, 696222 Villeurbanne Cedex, France (jessica.flahaut@ens-lyon.fr). [2]Department of Geological Sciences, Brown University, Providence, RI 02912.

Introduction: The early history of Mars is still unclear, and could be recorded in the walls of Valles Marineris, which are as deep as 11 km, and evidenced major discontinuities. Previous studies [1] show that the upper parts of the walls are likely made of layered basalts, related to Tharsis volcanism, in most of the chasmata. Beneath these basalts may be exposures of sedimentary deposits and Noachian crust [2,3].

The present study investigates the walls located in Coprates Chasma, using CRISM (The Compact Reconnaissance Imaging Spectrometer for Mars) and HiRISE (High Resolution Imaging Science Experiment) data. Coprates Chasma is an approximately 1000 km long and 150 km wide linear canyon which extends from Melas Chasma to Capri Chasma, at the outlet of Valles Marineris. As it has not been filled with large interior layered deposits (ILDs), Coprates Chasma has been proposed to be a graben that may have opened after that most of the canyons were already emplaced [4]. Therefore Coprates Chasma exhibits the most well-exposed cross-section of the upper-most material of the crust through its walls.

Spectral identification: CRISM multispectral and hyperspectral data were processed as in [5,6], and merged with CTX and HiRiSE data into a GIS. CRISM data have spatial resolutions ranging from 200 to 18 m/px while HiRiSE observations give details up to 25cm/px. Combining these data allows us to assess the units carrying the mineralogical signatures. Four spectral types were identified, corresponding to characteristic morphologies at different elevations. A typical cross-section of the walls in Coprates Chasma can then be established, and geological discontinuities can be assessed. The upper and middle part of the walls is generally depleted in any spectral signature. The mineralogy of the walls becomes really significative under -400 m in elevation, where Fe/Mg phyllosilicates are detected [7]. Low-calcium pyroxenes (LCP) are also identified within the walls [8]. They do not seem to be aligned at a constant elevation but are distributed -1400 and -2400m in the northern wall of Coprates Chasma. They are underlained by dark basal layers where olivine signature has been detected.

Morphological observations: The upper walls correspond to typical 'spurs and gullies' morphologies [9]; these dusty talus could reasonnably explain why we don't see any mineralogical signature. Phyllosilicates detections are generally associated to morphological dark boulders in the deepest spurs, and sometimes to some dusty talus inherited from the above boulders. At this depth, stratification is not visible anymore and the lower albedo of the rubbly deposits cropping out along the spurs suggests we have gradually reached another morphological unit in the stratigraphic sequence of the walls.

On the other hand, pyroxenes signatures are correlated with light-toned brecciated outcrops. There is a sharp contrast between this light-toned deposits, which look massive, indurated and made of bright clasts, and the overlying dark boulders of phyllosilicates. The typical 'spurs and gullies' leave place to a less competent bright material, forming a hole in the topography.

In the northern wall, this massive bedrock is underlained by thin dark layers, which correspond to by terraces that crosscut the walls around -4000m in elevation.

Nevertheless, in the central horst of Coprates Chasma, on one CRISM observation, this pyroxene-rich bright deposits seem underlained by another phyllosilicate-rich layer, sealed between two layers of volcanic rocks.

Conclusion: The cross-section of the walls of Valles Marineris exhibits different units, sometimes with sharp discontinuities, recording the past conditions of the surface. A simple lava stack cannot explain the entire cross-section observed in Coprates Chasma. The deepest exposures have compositions seen elsewhere in Noachian crust (enrichment in LCP and phyllosilicates). The uppermost Hesperian-aged layers are generally depleted of any infrared mineral signatures. The occurrence of a phyllosilicate –rich layer under the LCP-rich bright-deposits in the central horst could mark a alteration front, sealed by younger lava floods.

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