Geophysical Research Abstracts
Vol. 13, EGU2011-300, 2011
EGU General Assembly 2011

Evidence of Preserved Noachian Crust and Major Geologic Transitions in the Walls of Valles Marineris, Mars.

Jessica Flahaut (1), Cathy Quantin (1), John Mustard (2), Harold Clenet (1), Pascal Allemand (1), Janette Wilson (2), and Pierre Thomas (1)

(1) Laboratoire des Sciences 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.org) , (2) Department of Geological Sciences, Brown University, Providence, RI02912.

The relative importance of volcanism versus sedimentary deposition in the early history of Mars is still unclear. Some of this history is recorded in the walls of Valles Marineris, which are as deep as 11 km, and exhibit parts of the upper crust. Previous studies (Beyer and McEwen, 2005) show that the upper parts of the walls are likely composed of layered basalts, related to Tharsis volcanism, in most of the chasmata. Beneath these basalts are exposures of Noachian crust (Flahaut et al., 2010). Exposures of walls in the whole Valles Marineris area were investigated with both HiRiSE and CRISM data. A typical succession of horizontal units of distinct morphologies and mineralogies was observed in the Eastern part of Valles Marineris, while the composition of western Valles Marineris remains unclear. The stratification observed in the uppermost walls of Eastern Valles Marineris disappears with depth, and the few outcrops that are not obscured with dust are generally phyllosilicate-rich (Flahaut et al., 2010). This phyllosilicate-rich layer appears to correspond to an alteration layer composed of dark boulders rather than a sedimentary layer; no distinct sedimentary layers were actually found within the walls. These results favored the hypothesis that the large Interior Layered Deposits (ILDs) found in the central part of most of Valles Marineris chasmata, are younger than the canyon opening (Quantin et al., 2010). These phyllosilicate-rich boulders overlay an unaltered, pristine bedrock. This alteration layer could be the witness of the extensive weathering during the Noachian. The bedrock is enriched in Low-Calcium Pyroxene (LCP), which is commonly detected in old Noachian lava flows, while Hesperian mafic lavas are generally more High-Calcium Pyroxene (HCP) and olivine-rich (Mustard et al., 2005). The LCP-rich Noachian bedrock appears lighter-toned with HiRiSE, massive, and fractured. Several dikes were identified with both HiRiSE and CRISM observations for the first time in this preserved bedrock. They are a few kilometers long, up to 40 meters wide and appear to be filled with a bluer and darker material on the HiRiSE color observation, which is consistent with a mixture of olivine and pyroxene, according to CRISM spectra. Although the presence of dikes in the Valles Marineris area has been inferred in many studies (e.g, Mège et al., 2003), we report here the first direct observations and compositions obtained with high resolution data; this could present precious clues about magmatic processes in this area and on Mars in general. The occurrence of preserved Noachian bedrock in situ, which is rare on the Martian surface, and the extent of the geological records in these walls, contributes to the need for future Martian exploration in Valles Marineris.