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Mars surface compositional units: Number and type present from the Mars Express HRSC color images

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We have been analyzing multispectral images of the Mars surface delivered by the High Resolution Stereo Camera (HRSC) on the Mars Express Mission. Four of the HRSC detector channels are equipped with color filters in the wavelength ranges blue (440 ± 45 nm), green (530 ± 45 nm), red (750 ± 20 nm) and infrared (970 ± 45 nm). The remaining nadir/stereo channels are equipped with a 675 ± 90 nm filter. All five color channels are exposed simultaneously but for different look angles and different areas of Mars (associated with the separation of the linear detector arrays in the focal plane) as the image of the surface sweeps across the focal plane. This work requires investigating the spectrophotometric properties of the HRSC data, the calibration of the data, the different spatial samplings with detector array, and the effects of the atmosphere on the incident and reflected light from the surface. The HRSC color data reveal distinct and mappable spectral/compositional units at spatial resolutions of 50 to 150 m within the broad regional context provided by the vast coverage of the HRSC camera, a unique capability. In our first analysis, we chose four areas in Valles Marineris to characterize the data sets and to sample the number and nature of compositional units present. The type and distribution of compositional units on the Mars surface within the local and regional geologic and morphologic context are critical pieces of information for understanding the evolution of Mars, and so this is a powerful capability of the HRSC color data. We find at least three distinct compositional units that are present as relatively pure deposits and are mixed over broad areas within all four areas

analyzed. We have extracted and calibrated reflectance spectra for these units through the Mars atmosphere assuming the reflectance of one unit is unoxidized basalt. One unit is the widespread, fine-grained, red, iron-oxide-rich dust. A second appears to be unoxidized basaltic tephra that is exposed by erosion and has become mobile to form dunes and streaks that mix with the surrounding material. The third is consistent with salt minerals and is also wide spread and in many places mixed with other materials. We will describe the nature and distribution of these units for several of the regions studied and present our interpretation of their presence for Mars evolution.