N94-33217

S27-91 ABS.

GLOBAL COLOR VIEWS OF MARS. A. S. McEwen, L. A. Soderblom, T. L. Becker, E. M. Lee, and R. M. Batson, U.S. Geological Survey, Flagstaff AZ 86001, USA.

About 1000 Viking Orbiter red- and violet-filter images have been processed to provide global color coverage of Mars at a scale of 1 km/pixel. Individual image frames acquired during a single spacecraft revolution ("rev") were first processed through radiometric calibration, cosmetic cleanup, geometric control, reprojection, and mosaicking [1]. We have produced a total of 57 "single-rev" mosaics. Phase angles range from 13° to 85°. All the mosaics are geometrically tied to the Mars Digital Image Mosaic (MDIM), a black-and-white base map with a scale of 231 m/pixel [2].

The largest challenge in producing a global mosaic from Viking images with useful color and albedo information for the surface was the photometric normalization, including removal of atmospheric effects. First we selected a subset of single-rev mosaics that provide the best global coverage (least atmospheric obscuration and seasonal frost). A Minnaert photometric normalization was applied to normalize the variations in illumination and viewing angles. Image data acquired at illumination or emission angles larger than 77° were trimmed off, as these data are strongly affected by atmospheric scattering. A model image of condensate haze was created from the violet images, consisting of 60% of the violet-filter reflectance greater than 0.05, followed by smoothing over 20-km scales. The haze model was then subtracted from both the violet- and red-filter images. The residual polar caps were excluded from haze removal. This procedure is "conservative" in the sense that it errs on the side of undercorrecting for the haze. Finally, these normalized mosaics were combined with seam removal [3] into global mosaics. Global coverage is about 98% complete in the red-filter mosaic and 95% complete in the violet-filter mosaic. A green-filter image was synthesized from an average of the red- and violet-filter data to complete a three-color set. The Viking Orbiters acquired actual green-filter images covering about 60% of the martian surface.

Two final datasets have been produced: "cosmetic" and "scientific" versions. For the cosmetic version, gaps were filled by interpolation, the violet-filter images were given a divide filter to remove residual atmospheric hazes, and digital airbrushing was applied to the north polar region. The divide filter consists of dividing the value of each pixel by the average value over a 200-km^2 area surrounding each pixel. The north polar region contains the largest gaps and poorest color data due to the typical atmospheric conditions and the geometry of the Viking orbits. For large areas near the north pole with red-only coverage, the violet-filter coverage was synthesized using a function fit to actual Mars red- and violet-filter data. For the scientific versions, data gaps are left blank and the divide filtering and digital airbrushing were not applied. About 30% of the violet-filter data is obscured by hazes to an extent that makes the data unreliable for quantitative analyses of the surface color. We plan to mosaic the available green-filter images in the near future.

The final mosaics have been reprojected into several map projections: Sinusoidal Equal-Area (global), Lambertian Equal-Area (east- and west-hemisphere views), Polar Stereographic (one-half planet views of the northern and southern hemispheres), Mercator (equatorial region), and Orthographic views centered on six different positions. The Orthographic views are most like those seen by a distant observer looking through a telescope. All versions exist both with and without latitude-longitude overlays.

The color balance selected for these images was designed to be close to natural color for the bright reddish regions such as Tharsis and Arabia, but the data have been "stretched" such that the relatively dark regions appear darker and less reddish than their natural appearance. This stretching allows us to better see the color and brightness variations on Mars, which are related to the composition or physical structure of the surface materials. Note that these images are also unnatural because atmospheric effects have been (mostly) removed and because we see the summertime appearance of both polar caps simultaneously.

Five major surface units can be mapped from the global mosaics: (1) bright red regions such as Tharsis, Arabia, and Hellas, which have properties consistent with surface deposits of fine-grained dust such as that carried aloft by dust storms [4]; (2) dark regions, which have properties consistent with coarse-grained sand and rock fragments [4]; (3) intermediate brightness regions, which may represent rough, indurated surfaces [5]; (4) the bright north polar residual cap, which consists of water ice mixed with dust [6]; and (5) the very bright south polar residual cap, which probably consists of CO_2 ice [7].

The global color mosaics have been merged with the MDIM in a set of 30 quadrangles covering Mars at a scale of 462 m/pixel. These products show both the surface morphology as seen from imaging at low Sun elevation angles and the color and albedo information best seen at high Sun elevations. The datasets were merged by the following steps: (1) extract red and violet color data (cosmetic versions) for a quadrangle and make red/violet ratio; (2) reproject red and red/violet ratio to the same map projection and scale as the MDIM quadrangle; (3) choose match points and warp the color images to improve the geometric registration; (4) add the red and MDIM files to create a merged red; (5) divide the merged red by the red/violet ratio to make a merged violet; and (6) average the merged red and violet files to create a synthetic merged green image.

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N94-33218

S28-91 ABS. ON

THE DISTRIBUTION OF MARTIAN GROUND ICE AT OTHER EPOCHS. M. T. Mellon[1] and B. M. Jakosky[2], [1]Laboratory for Atmospheric and Space Physics, Department of Astrophysical, Planetary, and Atmospheric Sciences, [2]Department of Geological Sciences, University of Colorado, Boulder CO 80309-0392, USA.

The theoretical study of ground-ice stability for the present epoch has shown that ice within the martian regolith is stable poleward of about ±40° latitude with about 20°–30° of variation from one longitude to the next in the northern hemisphere (due to variations in the surface thermal properties). The depth of stability in this region was found to range from a couple of tens of centimeters to about a meter, being closer to the surface nearer to the pole. It was also found that atmospheric water vapor (at Viking-measured abun-