Recent Results from the Mars Exploration Rover Opportunity Pancam Instruments

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The Mars Exploration Rover (MER) Panoramic Camera (Pancam) instruments [1] are multispectral, stereoscopic CCD cameras that have acquired high resolution color images from the Spirit rover field site in Gusev crater and the Opportunity rover field site in Meridiani Planum. Spirit's mission ended in March 2010 after 2209 sols of operation and acquisition of more than 81,000 Pancam images. Opportunity's mission is ongoing, now spanning more than 3180 sols of operation as of early January 2013. As of this writing, the Opportunity Pancam instruments have acquired more than 106,000 images. Approximately 21% of those images have been acquired as part of 11-color multispectral "image cubes" used to characterize the color properties of the surface and atmosphere at wavelengths between 432 and 1009 nm. Most of the remainder of the imaging part of the rovers' downlink (which is the vast majority of the overall downlink) has been used for monochrome or limited-filter tactical imaging of targets of interest, stereo Navcam or Hazcam imaging in support of rover driving and/or rover arm instrument chemical, mineralogical, or Microscopic Imager measurements, photometric experiments, atmospheric dynamics and aerosol observations, and even occasional astronomical observations like solar transits of Phobos and Deimos. Less than 2% of the downlinked bits have been used for calibration observations (bias, dark current, flatfield, calibration target) over the course of the mission.

During the past Mars year, Opportunity arrived at Cape York, a northwestern segment of the rim of 22 km diameter Endeavour crater, and has been used to characterize the geology, geochemistry, and mineralogy of this ancient Noachian terrain. Pancam multispectral images have provided important data with which to help identify basaltic impact breccias within the crater rim materials, as well as gypsum-rich veins within the Meridiani plains sedimentary rocks adjacent to the rim. The continuing study of light-toned veins and fracture fills in this region includes an assessment of the hydration state of these materials using the longest-wavelength Pancam filters, which sample a weak H_2O and/or OH absorption in some hydrated minerals (such as hydrated sulfates) [2]. Multispectral imaging observations are also helping to constrain the distribution and origin of discontinuous dark coatings on many light toned outcrop rocks at Matijevic Hill, near the southern end of Cape York. These outcrop rocks have been hypothesized [3] to be the unit containing the Fe/Mg smectite phyllosilicates deposits identified in Cape York from MRO/CRISM orbital observations.

In this presentation I will discuss the major observations and scientific results in Meridiani that have been derived from or enabled by Pancam imaging observations, as well as provide an update on the most recent rover imaging and other results from Cape York in particular. Lessons learned in terms of the design, performance, remote operation, and analysis of multispectral CCD imaging observations from the Martian surface will also be discussed.

[1] J.F. Bell III et al. (2003) JGR, v108, E12; J.F. Bell III et al. (2006) JGR, v111, E02S03.
[2] M.S. Rice et al. (2013) this meeting; M.S. Rice et al. (2010) Icarus, v205, 375.
[3] S.W. Squyres et al. (2013) LPSC 44th; R.E. Arvidson et al. (2013) LPSC 44th.