CHARACTERISTICS OF THE MARS PATHFINDER LANDING SITE FROM CRISM HYPERSPECTRAL IMAGING. S. Murchie[1], J. Bishop[2], D. Humm[1], R. Morris[3], S. Pelkey[4], F. Seelos[1], K. Seelos[1], and the CRISM Science Team, [1]Applied Physics Laboratory, Laurel, MD (scott.murchie@jhuapl.edu), [4]NASA/ARC, Moffett Field, CA, [8]NASA/JSC, Houston, TX, [9]Brown University, Providence, RI.

Introduction: Preliminary analysis of CRISM imaging of the Mars Pathfinder landing site is consistent with previously reported results from landed imaging. At tens of meters scale, the surface is largely dust-covered. Lee portions of topographic knobs are reddest and show most evidence for ferric mineralogy. The nearby 1.5-km diameter "Big Crater" exposes olivine, which is atypical of the northern plains. Big Crater may have penetrated northern plains material to expose buried basaltic highlands.

Background: The Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) is a hyperspectral imager on the MRO spacecraft [1]. Separate images obtained by visible/near-infrared (VNIR) and infrared (IR) detectors together cover the wavelength range 362-3920 nm in 544 channels at 6.55 nm/channel. CRISM operates in both mapping and targeted modes. In targeted mode, the camera is scanned to remove most along-track motion, and a region of interest is mapped at full or half spatial resolution (~18 or ~36 m/pixel) and full spectral resolution. The imaging duration is typically 1.5-3 min, during which range to target and atmospheric path length vary.

Most information on spectral properties of the Mars Pathfinder landing site comes from 12-color, 440-1000 nm landed imaging by the Imager for Mars Pathfinder (IMP) [2-5]. Most rocks at the site ("gray rocks" of [2-5]) have a reflectance peak at 750-800 nm with decreasing reflectance toward longer wavelengths, but lack evidence for a 1-µm mafic mineral band. The Si-rich composition of the rocks resembles that of TES type-II rocks prevalent on the northern plains [6]. Near-infrared spectra from the OMEGA instrument on Mars Express show that the type-II materials also lack the 1-µm band that is characteristic of basaltic type-I materials [7]. However a small fraction of the rocks at the landing site site ("black rocks" of [4,5]) do show evidence for a well-defined 1-µm band, as well as a reflectance peak offset to shorter wavelengths, near or below 700 nm. The deeper 1-µm band and shifted peak are consistent with an enhanced content of olivine [4,5].

In addition, IMP images show that most surfaces on the lee (W to SW) sides of rocks are coated with "brown" material that, compared to dust, is redder and has a reflectance peak offset to longer wavelengths (≥800 nm). Some examples of brown coatings show evidence for a deeper 900-nm band than in dust, possibly suggesting enrichment in crystalline ferric minerals [2,8].

Overview of CRISM Results: A full-resolution targeted observation of the Mars Pathfinder landing site was obtained by CRISM on 21 Dec 2006. Both VNIR and IR data were calibrated against an internal source [1], and a transmission spectrum of the atmosphere acquired during a nadir-pointed scan across Olympus Mons was used for a first-order correction for atmospehric gas absorptions. The resulting images are shown in map-projected form in Figures 1 and 2. The hourglass shape of the coverage and a slight north-south gradient in color come from the changes in range and atmospheric path length whle the target was tracked during its overflight.

The plains surrounding the landing site are largely dust-covered; material with a shallower 530-nm absorption - characteristic of dust - is exposed in the interiors of small craters as well as "Big Crater," a 1.5-km impact located SSE of the landing site (Figure 2, red image plane). Big Crater is distinguished from the smaller craters by a reflectance peak that is offset toward shorter wavelengths (Figure 3) and a larger integrated falloff in reflectance into the 1-µm band (Figure 2, green image plane). Compared to surrounding plains, at IR wavelengths Big Crater exhibits a ~3% depth 1-µm band with a long-wavelength wing near 1700 nm. It is similar in shape to but shallower than a similar band discovered by OMEGA in some large craters in the northerm plains (Figure 4).

The lee sides of topographic knobs NW of the landing site exhibit the enhanced 530-nm absorption also observed in IMP imaging. At a tens of meters scale an enhanced 900-nm band is not evident (Figure 3), and at IR wavelengths there is no evidence for absorptions at 1400-2400 nm that characterize many hyroxylated ferric minerals and hydrated ferric sulfates.

Preliminary Interpretation: Preliminary analysis of the CRISM data supports and extends results from IMP imaging. Big Crater's shorter-wavelength reflectance peak and 1-µm absorption band extending to 1700 nm are consistent with an enhanced content of olivine compared to the local northerm plains. This suggests that Big Crater is the source of "black rocks" exposed at the landing site, and that it penetrated the local type-II materials to expose type-I material buried only to a depth of a few hundred meters. The lack of IR ferric mineral absorptions on the lee sides of knobs indicates that their visible-wavelength spectral properties result from textural effects, or from minerals such as hematite or maghemite that do not have distinctive IR absorptions.

References: [1] Murchie, S. *et al.* (2006) *J. Geophys. Res.*, in press. [2] McSween, H. *et al.* (1999) *J. Geophys. Res., 104,* 8679-8716. [3] Bell III, J.F. *et al.* (2000) *J. Geophys. Res.*, *105*, 1721-1755. [4] Murchie, S. *et al.* (2000) *Lunar Planet. Sci. XXXI*, #1267. [5] Bell III, J.F. *et al.* (2002) *Icarus*, *158*, 56-71. [6] C. Foley *et al.* (2003) *J. Geophys. Res.*, *108*, 8096, doi:10.1029/2002JE002019. [7] Mustard, J. F. *et al.* (2005) *Science*, *307*, 1594-1597. [8] Murchie, S. *et al.* (2004) *Lunar Planet. Sci. XXXV*, #1740.

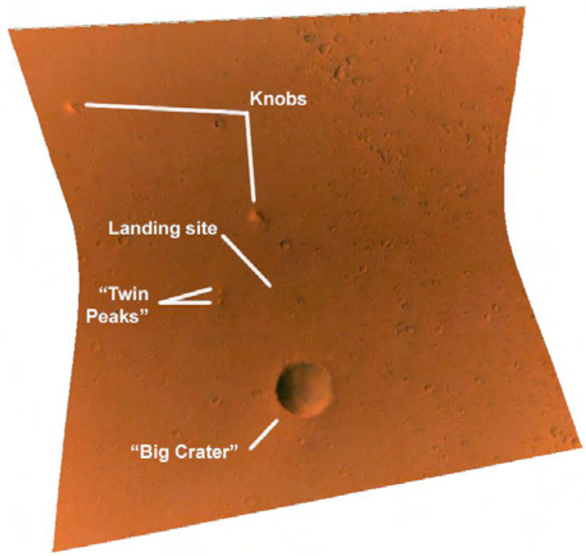

Fig.1. Annoted image in approximately true color and simple cylindrical projection. The scene is 11 km across at the narrowest. Image ID FRT000037C3_07.

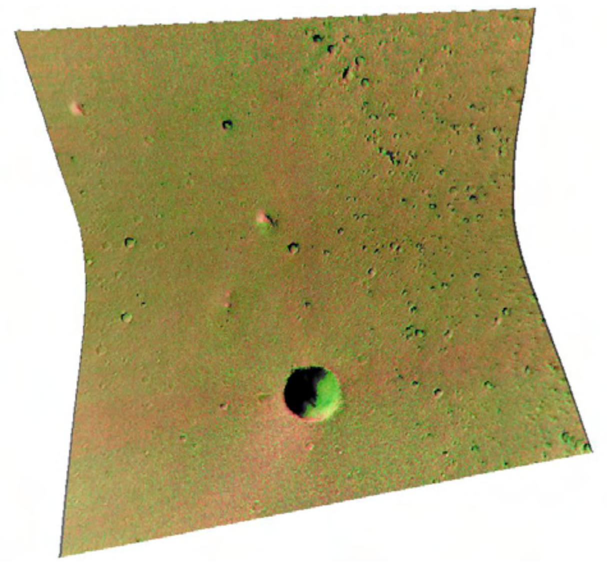

Fig. 2. False color image showing spectral variability of the landing site, overlain on a 853-nm simple cylindrical map projected image to show topographic features from shading. R = 530-nm ferric iron band depth, G = integrated falloff in reflectance from the 700-800 nm reflectance peak into the 1-µm band.

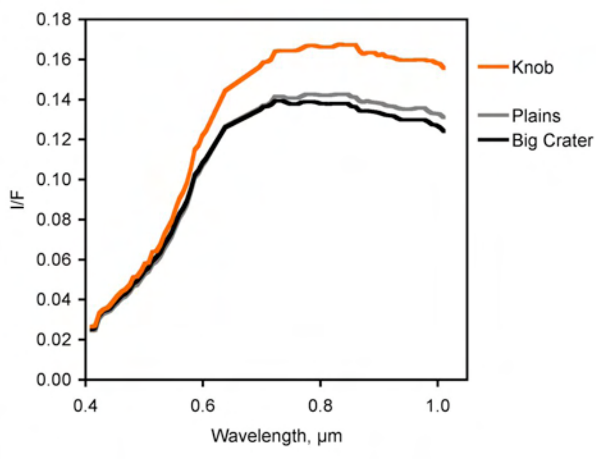

Fig. 3. Spectra of key features from the visible/near-infrared (VNIR) detector.

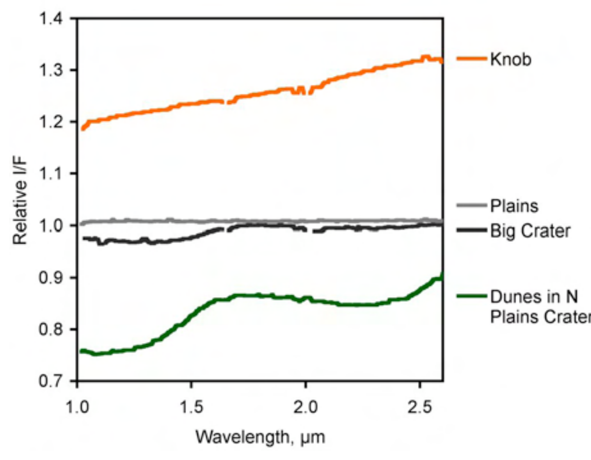

Fig. 4. Spectra of key features from the infrared (IR) detector. Spectra have been corrected for atmospheric gas absorptions, and ratioed to plains surrounding the landing site to highlight spectral variations.