FIRST RESULTS FROM THE COMPACT RECONNAISSANCE IMAGING SPECTROMETER FOR MARS (CRISM). S. Murchie[1] and the CRISM Science and Engineering Teams, [1]Applied Physics Laboratory, Laurel, MD (scott.murchie@jhuapl.edu).

Introduction: The Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) is a hyperspectral imager on the MRO spacecraft [1]. CRISM's objectives are (1) to map the entire surface using a subset of bands to characterize crustal mineralogy, (2) to map the mineralogy of key areas at high spectral and spatial resolution, and (3) to measure seasonal variations in the atmosphere and surface. These objectives are addressed using three major types of observations. In multispectral survey mode, with the instrument pointed at planet nadir, data are collected at a subset of 72 wavelengths covering key mineralogic absorptions, and binned to pixel footprints of 100 or 200 meters. Nearly the entire planet can be mapped in this fashion. In targeted mode, CRISM is scanned to remove most along-track motion, and a region of interest is mapped at full spatial and spectral resolution (15-19 m/pixel, 362-3920 nm at 6.55 nm/channel, 544 channels). Ten additional abbreviated, spatially-binned images are taken before and after the main image, providing an emission phase function (EPF) of the site for atmospheric study and correction of surface spectra for atmospheric effects. In atmospheric mode, only the EPF is acquired. Global EPF grids are taken regularly to measure seasonal variations in the atmosphere.

Early activities have had four areas of focus: (a) multispectral survey, utilizing half of the orbits during the early part of MRO's nominal mission, or Primary Science Phase (PSP); (b) targeted observations of key regions, totaling 192 through 1 Jan 2007; (c) regular acquisition of global grids of EPFs, including 257 observations through 1 Jan 2007; and (d) monitoring of seasonal changes in polar frost.

Multispectral Survey: As of early January 2007 coverage is nearly complete at high northern latitude, and is approaching 20% at lower latitudes. Spatial resolution is sufficient to resolve spectral differences at the scale of the Viking Digital Image Model, or MDIM (Figure 1). These data will be delivered to the community map-projected, as 1,964 72-color image tiles at 256 pixels/degree.

Targeted Observations of the North Polar Cap: Early targeted observations, taken in late northern summer, focused on the north polar region while favorable lighting persisted. Much of the wall of Chasma Boreale was imaged at high resolution (Figure 2). This region has excellent exposures of the basal unit, a lower-albedo deposit that underlies the polar layered deposits (PLD) [2]. CRISM data show that the PLD exhibits intricate layering in its water ice spectral signature strength, due to variation in either or both ice abundance or grain size at the optical surface. The steeply sloped upper basal unit spectrally resembles dune deposits on the chasma floor and exhibits water-ice absorptions only on talus cones. The more shallowly sloped lower basal unit exhibits little or no spectral evidence for ice, but otherwise resembles the PLD.

Targeted Observations of Sulfate Regions: A major discovery of the OMEGA imaging spectrometer on Mars Express is that many of the Hesperian-aged layered deposits, including those in Valles Marineris [3] and Terra Meridiani [4], are rich in sulfates. There is spectral evidence for monohydrated and polyhydrated Mg sulfates as well as for gypsum. The north polar erg is also rich in gypsum [5]. CRISM observations (Figure 3) show that gypsum is correlated with the dunes, and depleted in a higher-albedo layer underlying them. Ongoing imaging is attempting to determine if the erg is compositionally related to the basal unit of the PLD.

Targeted Observations of Phyllosilicate Regions: Another OMEGA discovery is that portions of the lower and middle Noachian highlands crust contain Fe-rich phyllosilicate [6.7], an indicator of aqueous weathering at a more moderate pH than that in which sulfates formed. Figure 4 shows one of these areas, Mawrth Vallis. CRISM's high spatial resolution has enabled it to identify previously unrecognized deposits of Al-rich clay in this area, as well as to correlate both the Fe- and Al-rich clays with different strata of the layered deposits.

Monitoring of Seasonal Phenomena: Deep, distinctive absorptions due to both H_2O and CO_2 frosts allow CRISM to map seasonal changes in frost distribution and to estimate frost grain sizes [8]. In part this is accomplished using the ongoing multispectral survey. Targeted observations of representative regions allow monitoring of frost characteristics at a tens-of-meters spatial scale (Figure 5).

References: [1] Murchie, S. *et al.* (2006) *J. Geophys. Res.*, in press. [2] Fishbaugh, K. and J. Head (2005) *Icarus*, *174*, 444–474. [3] Gendrin, A. *et al.* (2005) *Science*, *307*, 1587-1591. [4] Arvidson, R. *et al.* (2005) *Science*, *307*, 1591-1594. [5] Langevin, Y. *et al.* (2005) *Science*, *307*, 1584-1587. [6] Bibring, J.-P. *et al.* (2005) *Science*, *307*, 1576-1581. [7] Poulet, F.*et al.* (2005) *Nature*, *438*, 570-571. [8] Langevin, Y. *et al.* (2005) *Science*, *307*, 1581-1584.

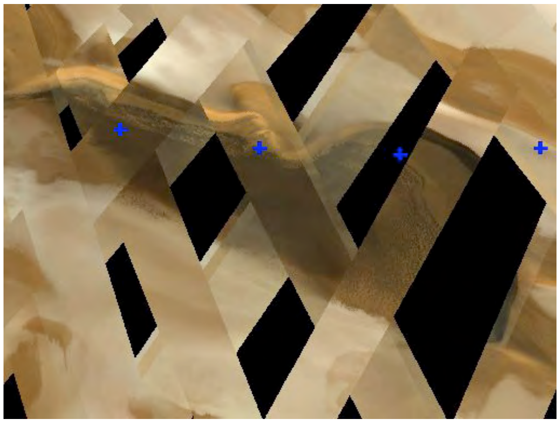

Fig.1. Mosaicked multispectral survey data covering Chasma Boreale. The bands shown are 592, 533, and 442 nm. No correction has been applied for atmospheric effects. The whole scene is approximately 100 km across. The blue crosses are fiducials every 5° of longitude at 85°N.

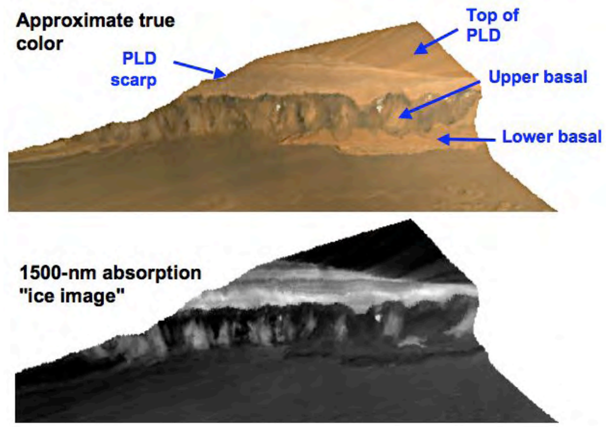

Fig. 2. Targeted image of Chasma Boreale overlain on MOLA topography. Perspective view with no vertical exaggeration; the escarpment is approximately 900 m high. Top: 3-band visible wavelength composite (592, 533, 442 nm). Bottom: Depth of the 1.5-µm water ice absorption. Brighter areas have a stronger absorption. Image ID FRT00002854_07.

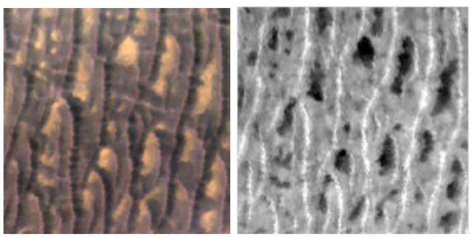

Fig. 3. Portion of a targeted image covering gypsum-rich dunes in Olympia Undae. Left: IR false color composite of 2528-, 1050-, and 1078-nm bands. The bright spots are in low inter-dune areas. Right: Strength of the 1.9-µm absorption due to bound water in gypsum. Brighter areas have a higher gypsum content. Gypsum is prevalent in the dunes, and depleted in the bright areas. Image ID FRT0000285F_07. The scene is approximately 3 km across.

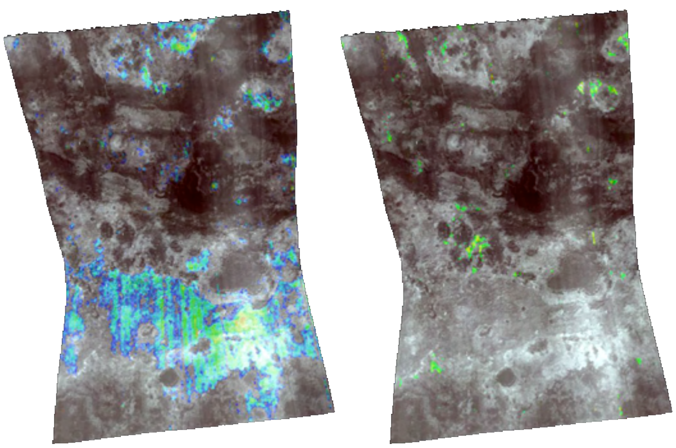

Fig. 4 (left). Monochrome IR images of the Mawrth Vallis region, in simple cylindrical map projection. Colored regions in the left image have a 2.3-µm absorption indicative of Fe-rich clay, and colored areas at right have a 2.2-µm absorption indicative of Al-rich clay. Image ID HRL0000285A_07. The image is 11 km across at its narrowest.

Fig. 5 (below). Left: Map-projected, IR false color composite of a crater rim near 40°S latitude in local mid-winter, constructed from from 2528-, 1050-, and 1078-nm bands. Bluish areas are frost. Right: IR false color composite showing derived spectral parameters. R = I/F at 1330 nm, G = strength of the 1.45-µm absorption due to CO_2 frost, B = strength of the 1.5-µm absorption due to H_2O frost. Image ID FRT00003266_07.