HiRISE OBSERVATIONS OF MARS. A. S. McEwen[1], and the HiRISE team. [1]University of Arizona, Department of Planetary Sciences, Tucson, AZ, 85721 (email: mcewen@lpl.arizona.edu).

Introduction: The High Resolution Imaging Science Experiment (HiRISE) is sampling the Martian surface at 25-32 cm/pixel scale [1]. We have concentrated on sampling diverse terrains (Fig. 1), but with emphasis on the North Polar region (since we began in late northern summer), the candidate Phoenix landing latitude belt of 65-72 N, and concentrations of images over regions of special interest such as Valles Marineris, Meridiani Planum, Athabasca Valles, and mid-latitude gullies. About 1 Tb of HiRISE data has been returned via ~700 images in the first 60 days; 50 stereo pairs have been completed.

HiRISE color coverage in the center of the swath width has proven especially valuable for correlation of units and to remove the ambiguity between topographic shading and intrinsic brightness of the surface materials. The blue-green (~536 nm) vs. red (~692 nm) images map the visible continuum slope, while the near-IR (~874 nm) vs. red is sensitive to variations in ferric mineralogy.

HiRISE images are identified by the format mission-phase_orbit-number_orbital-position. For example, image PSP_1468_1535 was acquired in the Primary Science Phase (PSP), Mars orbit 1468, and 153.5 degrees from the night side equator or 26.5 S latitude (MRO ascends or moves north over the day side.)

Science Themes: Each HiRISE suggested observation is assigned to a science theme, and a member of the science team then prioritizes each observation within a theme. Table 1 provides a summary of observations planned and acquired (as of 5 Jan 2007) within each theme. There is overlap between themes, and most images are relevant to more than 1 theme, but we have found this to be a reasonable way to maintain science balance. The number of suggestions for Aeolian Processes is unusually large due to inclusion of a dune database. The number of completed images is largest for Landing Sites due to many small images acquired to help the Phoenix lander team select the best landing site [2]. The theme Other is largely for observations planned or acquired in "ridealong" mode with targets selected by the CRISM or CTX teams, prior to reassignment to one of our science themes.

Science Results: There will be a series of presentations at this conference to explore early HiRISE results for a broad range of topics. Here we highlight two topics.

Ubiquitous Boulders at Mid to High Latitudes: Rocks from 0.5 to 2 m diameter are ubiquitous in the mid to high-latitude regions of Mars. This includes all samples of the Vastitas Borealis Formation (VBF) covering most of the northern plains. The greatest concentrations of boulders are around impact structures, including large boulders previously detected by MOC. However we see smaller boulders everywhere we've imaged at mid to high latitudes when they aren't buried by aeolian materials, and with a fairly uniform distribution within the upper tens of meters exposed in cross-section (e.g., Fig. 2). The ~100-m thick VBF has been hypothesized to consist of fine-grained ocean sediments [3], but the uniform distribution of boulders is difficult to reconcile with this hypothesis. Perhaps fine-grained sediments were lithified and then broken up by impacts, but the rocks surrounding VL-2 appear more consistent with basalt. Rapidly-emplaced and frozen flood deposits [4] may be difficult to reconcile with the lack of sorting. Boulder-rich units of similar morphology are also ubiquitous in the southern highlands where both the flood and mudflow [5] hypotheses are unlikely. The deposits that appear pasted onto crater slopes, and hypothesized to be dusty snow packs [6], are also rich in boulders (PSP_1942_2310). The presence of widespread glacial till [7] is one hypothesis that could explain the ubiquitous boulders, or perhaps some combination of periglacial and aeolian processes has modified the surface layer. Polygons are also ubiquitous over these terrains.

Gullies are Active: The mid-latitude gullies have attracted great interest because they may indicate that liquid water briefly visits the surface even in the present-day climate. Channels down to the limits of HiRISE detection (~0.5 m wide) are common in these locations. In pole-facing slopes of the southern hemisphere there are often dark inner channels where it appears than seasonal frost and dust has been removed, but it is not clear if this seasonal process serves to gradually enlarge the gullies or is just a very surficial process.

Observations of new bright deposits corresponding to the depositional fans of gullies suggest activity in recent years [8]. HiRISE has imaged one of these deposits in stereo (PSP_1714_1415 and 2136_1415), and the bright material appears to have been deposited by some especially recent gully channels (which cut other channels). There is no sign of aeolian deposition onto or erosion of the bright deposit. The gully source region is distributed, not pointing to a localized groundwater origin. There are bright regions cut by the source gullies so perhaps the new bright deposit is from redeposition of this pre-existing bright material. The bright deposit flows around topography in a manner consistent with a low-velocity viscous flow. Color

properties are not consistent with either dust or frost. Bright gully fans at another location appear in HiRISE stereo images (PSP_1714_2390 and 1846_2390) to consist of rippled aeolian deposits on relatively old gully deposits.

References: [1] McEwen A.S. et al. (2007) *JGR*, in press. [2] Golombek, M.P. et al., this conference. [3] Krevlavsky, M., and Head, J. (2002) JGR 107, CiteID 5121. [4] Carr, M.H. and Head, J.W. (2003) JGR 108, CiteID 5042. [5] Tanaka, K. et al. (2003) JGR 108, CiteID 8043. [6] Christensen, P. (2003) Nature 422, 25. [7] Kargel, J. et al. (1995) JGR 100, 5351. [8] Malin, M.C. et al. (2006) Science 314, 1573.

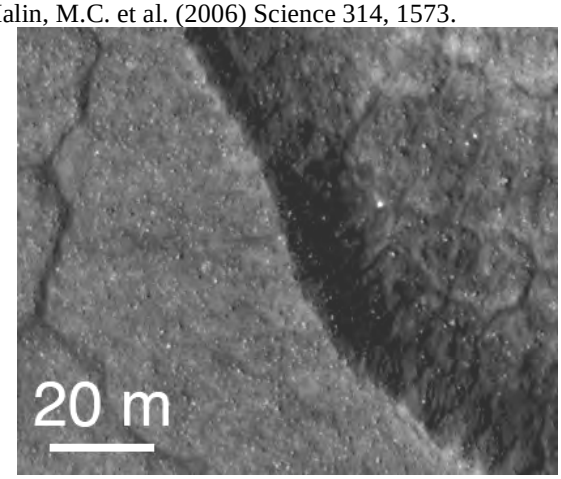

Fig. 2. Very small sample of TRA_856_2265 showing boulders in the Vastitas Borealis Fm.

Table 1. HiRISE Observations of Mars

Science Theme	# Suggestions	# Completed
Climate Change	33	1
Composition and Photometry	59	8
Aeolian Processes	2105	28
Fluvial Processes	553	44
Landing Sites	542	151
Geologic Contacts/Stratigraphy	271	25
Glacial/Periglacial Processes	1054	54
Hydrothermal Processes	18	1
Impact Processes	232	36
Landscape Evolution	138	32
Mass Wasting Processes	254	16
Other	127	53
Polar Geology	444	81
Rocks and Regolith	392	23
Seasonal Processes	359	18
Sedimentary/Layering Processes	535	79
Tectonic Processes	368	26
Volcanic Processes	432	30

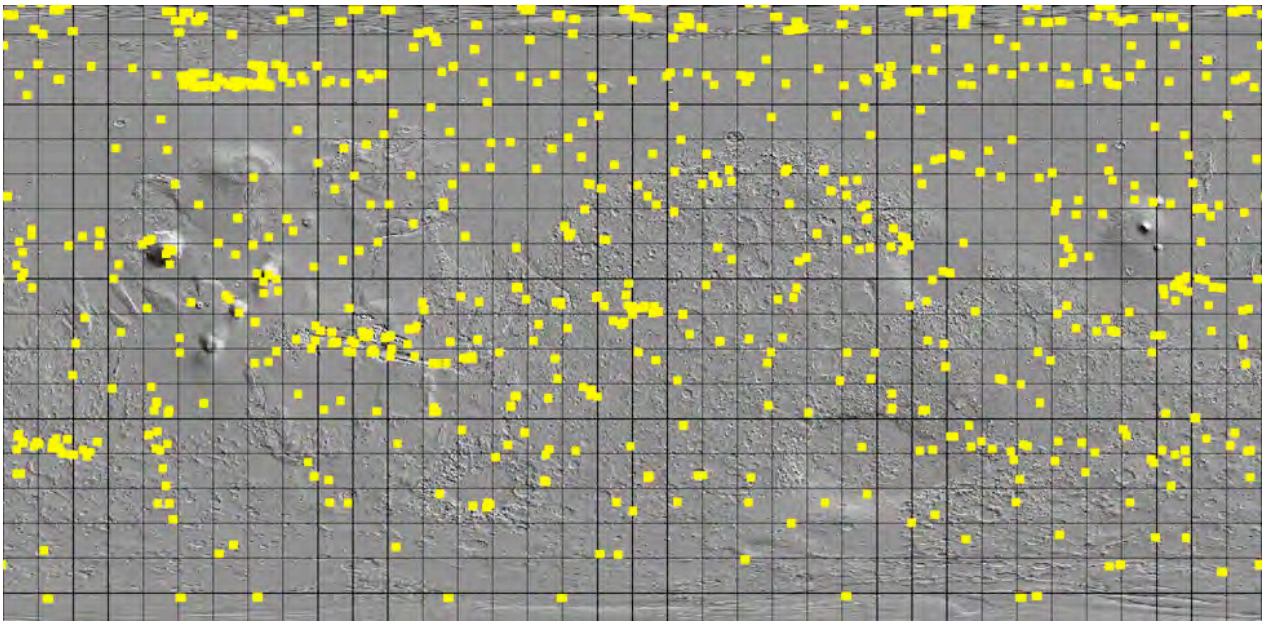

Figure 1. Plot of locations of HiRISE images of Mars acquired through the end of 2006. Simple Cylindrical global map.