EARLY HIRISE OBSERVATIONS OF FLUVIAL AND HYDROTHERMAL FEATURES. V.C. Gulick[1], A. S. McEwen[2], and the HiRISE team. [1] NASA Ames/SETI Institute, MS 239-20, NASA Ames Research Center, Moffett Field, CA 94035, (email: vgulick@mail.arc.nasa.gov), [2]University of Arizona, Department of Planetary Sciences, Tucson, AZ, 85721

Introduction: The surface of Mars has been extensively modified at all scales by fluvial processes. The High Resolution Imaging Science Experiment (HiRISE) camera onboard the Mars Reconnaissance Orbiter is extending our understanding of these features to scales familiar to a terrestrial geologist hiking along a streambed. At the time of the preparation of this abstract, more than 40 images of fluvial and hydrothermal features had been obtained. Fluvial landforms are also sometimes imaged as part of other science themes including glacial/periglacial, landscape evolution, and mass wasting. While these early images sample the diversity of Mars' fluvial features, they have primarily focused on the relatively young Martian gullies. Here we briefly summarize some of these early images.

Gullies: Some of the most spectacular HiRISE images have been of gullies formed on the interior slopes of impact craters and elsewhere. Notable features seen in the images include details of the theater heads in some cases (see Figure 2), multiple elevations for source regions in some gullies [1], source regions perhaps originating from more resistant layers, braiding and anastomosing of middle reaches where the slope flattens, and deposition and dissection of overlapping alluvial fans in distal reaches. Stream channel features are detectable, including what appear to be channel bars and downcutting into the underlying surfaces. Gullies are commonly associated with polygonally fractured terrain and have sometimes eroded the polygonal pattern. Other gullies are clearly older than subsequent polygons or aeolian deposits. The CRISM team has reported that at least some polygonal terrains are composed of clays.

Figure 1 illustrates several of these features. This gully system in Terra Sirenum originates in the blocky, more resistant layers of the upper crater wall. The braided and anastamosing middle reach suggests a fluvial origin for these gullies. Mudflows or dry debris flows would not generally form such morphologies. These gullies are eroded down into the crater wall and are not simply superimposed on top, as one would expect for some non-fluvial alternatives. Along some reaches, gully channels are notably darker than the surrounding material, perhaps implying recent removal of a dust mantle or seasonal frost by fluid flow.

Figure 2 shows an example of theater-headed tributaries and a dark interior channel within the gully. Large boulders and debris that have fallen into the gully are apparent.

HiRISE has also imaged some of the new bright gully deposits that have appeared within the last few years [2]. The headwaters of one such gully (Figure 3) clearly cut a unit consisting of alternating bright and dark layers. The bright deposit originally seen in the MOC images may arise simply from the redeposition of the bright layered material. The bright deposit may fade in time due to eolian mantling or removal. In addition, small exposures of bright deposits are seen elsewhere upslope particularly on knobs and on sides of some parallel gully reaches (Figure 4) suggesting that these bright deposits may underlie surface materials. Fluid flows may have eroded and transported this bright material and deposited it at the surface.

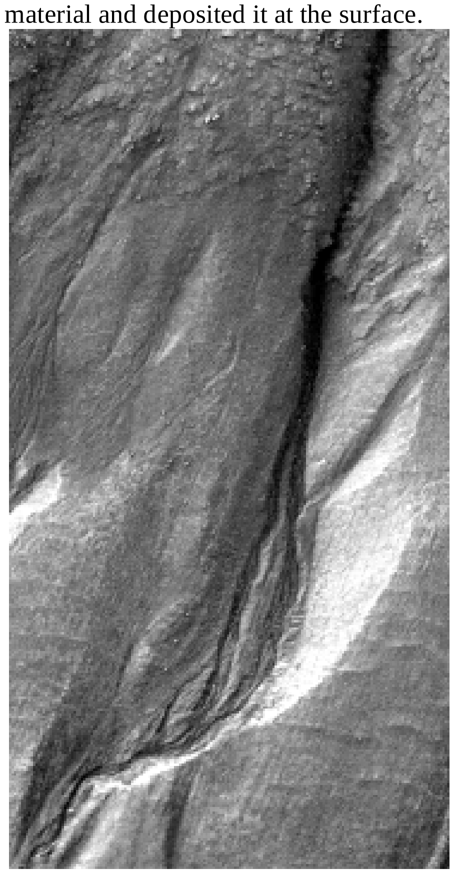

Figure 1: Gullies in the shadowed region of a crater in Terra Sirenum. Portion of HiRISE image TRA_000878_1410.

Gullies have also been seen in other terrain types, including along the faces of sand dunes, notably in Russell Crater. These gullies may have formed partly by sudden release of gaseous subsurface volatiles [3] and may represent a different end member formation mechanism.

Figure 2: A portion of HiRISE image PSP_1712_1405 showing theater headed gully tributaries with inner channels and infalling debris. Bright material is frost.

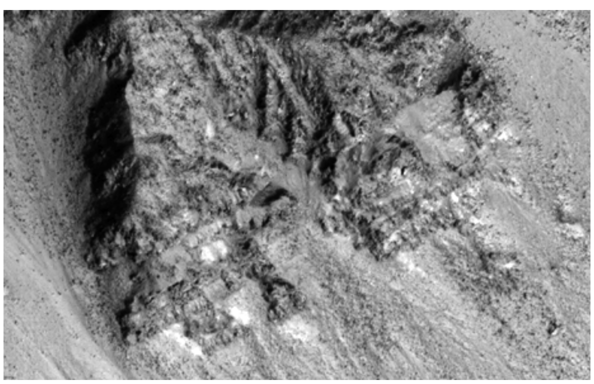

Figure 3: A small cutout of HiRISE image PSP_001714_1415 showing the headwaters of the gullies shown in Figure 4 that contain the recent bright deposits as identified by Malin et al. [2].

Figure 4: Another small cutout of HiRISE image PSP_001714_1415 showing bright gully deposits as identified by Malin et al. [2]. Note subtle additional bright material along parallel gully features, particularly to the lower left of the image.

Valley Networks: Early HiRISE imaging has focused on the gullies and thus comparatively few images of valley networks have been obtained at the time of the writing of this abstract. The early images show features previously recognized at MOC scale. Future imaging will focus on valley headwaters, valley walls, floors and termini on a variety of terrains, including the volcanoes.

Outflow Channels: HiRISE is focusing on imaging the source regions to better understand origin, searching for evidence of paleoflood stage indicators, such as slackwater deposits, channel bars, and boulders transported by floodwaters. Early images of Athabasca Valles suggest a complex history in which the flood channel was later covered by a thin veneer of extremely fluid lavas [4].

Hydrothermal Systems: One image of a putative hydrothermal system has been obtained to date, but a number of other images show possible evidence of past hydrothermal activity. Evidence for groundwater outflow along fractures and joint sets includes bleaching[5,6,7]

References: **[1]** Kolb et al., LPSC 2007, abstract # 1391. **[2]** Malin, M.C. et al. (2006) Science 314, 1573. **[3]** Hansen et al., LPSC 2007. **[4]** Jaeger et al. LPSC 2007. [5] Okubo & McEwen, Science, in press. [6] Davatzes and Gulick, 2006, Fall AGU mtg. [7] Davatzes and Gulick, LPSC 2007.