ONGOING AND PLANNED LONG DISTANCE REMOTE MICRO IMAGER OBSERVATIONS OF TARGETS ON AEOLIS MONS IDENTIFIED FROM ORBIT. R.B. Anderson[1], C.M. Dundas[1], L.A. Edgar[1], O. Gasnault[2], S. Le Mouélic[3], H. Newsom[4], N. Bridges[5], R.C. Wiens[6], J. Frydenvang[6], A. Vasavada[7] , M.D. Day[8] [1]United States Geological Survey Astrogeology Science Center (rbanderson@usgs.gov), [2]Institut de Recherche en Astrophysique et Planétologie, [3]Univ. Nantes, [4]University of New Mexico, [5]Johns Hopkins University Applied Physics Laboratory [6]Los Alamos National Laboratory, [7]Jet Propulsion Laboratory, [8]U. Texas, Austin

Introduction: The ChemCam Remote Micro Imager (RMI) on the Curiosity rover was designed primarily to determine the exact location and context of Laser Induced Breakdown Spectroscopy (LIBS) analysis points [1,2]. However, the RMI can also be used to make "stand-alone" observations of more distant targets. It has an angular resolution of 19.6 µrad/pixel and thus provides the highest available resolution for long distance images of geologic features at the landing site [3].

For single focal plane images, the shallow depth of field poses a challenge for focusing long distance observations. Therefore, the standard procedure had been to acquire multiple stacked focal planes to yield a well-focused composite [3], a data intensive process. However, the failure of the continuous wave laser (CWL) used to focus ChemCam for LIBS observations led to the development of an autofocus algorithm that uses the RMI. In addition to renewing the ability to automatically focus for LIBS analysis, this new autofocus algorithm has greatly improved the focusing ability for long distance RMI observations.

At distances closer than ~12.8 km, the RMI has a pixel scale better than the 25 cm/pixel images returned by the High Resolution Imaging Science Experiment (HiRISE) on the Mars Reconnaissance Orbiter (MRO). Here we present initial results and future plans for long distance RMI observations of two enigmatic feature types observed by HiRISE on Aeolis Mons ("Mt. Sharp"): small lineae and a light-toned yardang-forming geologic unit.

Light-toned Yardang Forming Material: The Light-Toned Yardang forming material (LTY) was described in detail by [4] and was previously noted to lie unconformably on the darker strata beneath it, most vividly illustrated by a partially buried crater exposed near the edge of the LTY [5]. The unit itself contains no craters, suggesting that it is relatively young or rapidly eroding. It is characterized by a surface texture dominated by large flutes interpreted as yardang abrasion textures. In most locations, HiRISE images do not resolve any layering in the unit, although [4] observed that there are some exposures indicating fine-scale layering (Figure 1b). Shortly after Curiosity's landing in Gale crater, Mastcam observations provided the first view of the LTY from the planet's surface, and the texture of the LTY suggested that aeolian erosion may be exploiting large-scale clinoforms in the unit, which could have important implications for the origin of the LTY.

A recent long distance RMI observation of the unit (Figure 1) reveals additional evidence for fine-scale horizontal layers, but some beds also appear to dip, following the orientation of the yardang surfaces, so the presence of clinoform structures influencing the larger-scale texture cannot be ruled out. Additional RMI observations of the LTY as the rover approaches Mt. Sharp are planned, and should provide additional detail to aid in interpreting the LTY internal stratigraphy.

Small Lineae: Many narrow lineae have been observed on the slopes of Mt. Sharp in HiRISE images (Fig. 1a)[6]. Long-distance RMI observations of these locations could identify additional small features and provide ongoing monitoring to better understand the nature of the slope activity in Gale crater and elsewhere.

To determine which of the lineae locations will be visible from the rover, we conducted viewshed analyses using a HiRISE digital terrain model (DTM). An example viewshed for one location with identified lineae is shown in Figure 2b.

In addition to monitoring locations known to contain lineae, the RMI can also be used to monitor other steep slopes on Mt. Sharp to search for additional evidence of activity. Figure 2c shows the cumulative visibility from the rover, based on a notional traverse from the rover's current location through the phyllosilicate-bearing trough. Slopes highlighted in red will be visible for a considerable portion of the planned traverse, enabling recurring observations with the RMI and Mastcam.

References: [1] Wiens, R.C., et al. (2012). Space Science Reviews 170, 167–227.[2] Maurice, S., et al. (2012) Space Science Reviews 170, 95–166. [3] Le Mouélic, S. et al. (2015) Icarus, 249, 93-107. [4] Anderson R.B. and Bell J.F. III (2010), The Mars Journal 5, 76–128. [5] Malin, M.C., Edgett, K.S., (2000) Science 290, 1927–1937. [6] Dundas, C.M., McEwen, A.S. (2015). Icarus 254, 213–218.

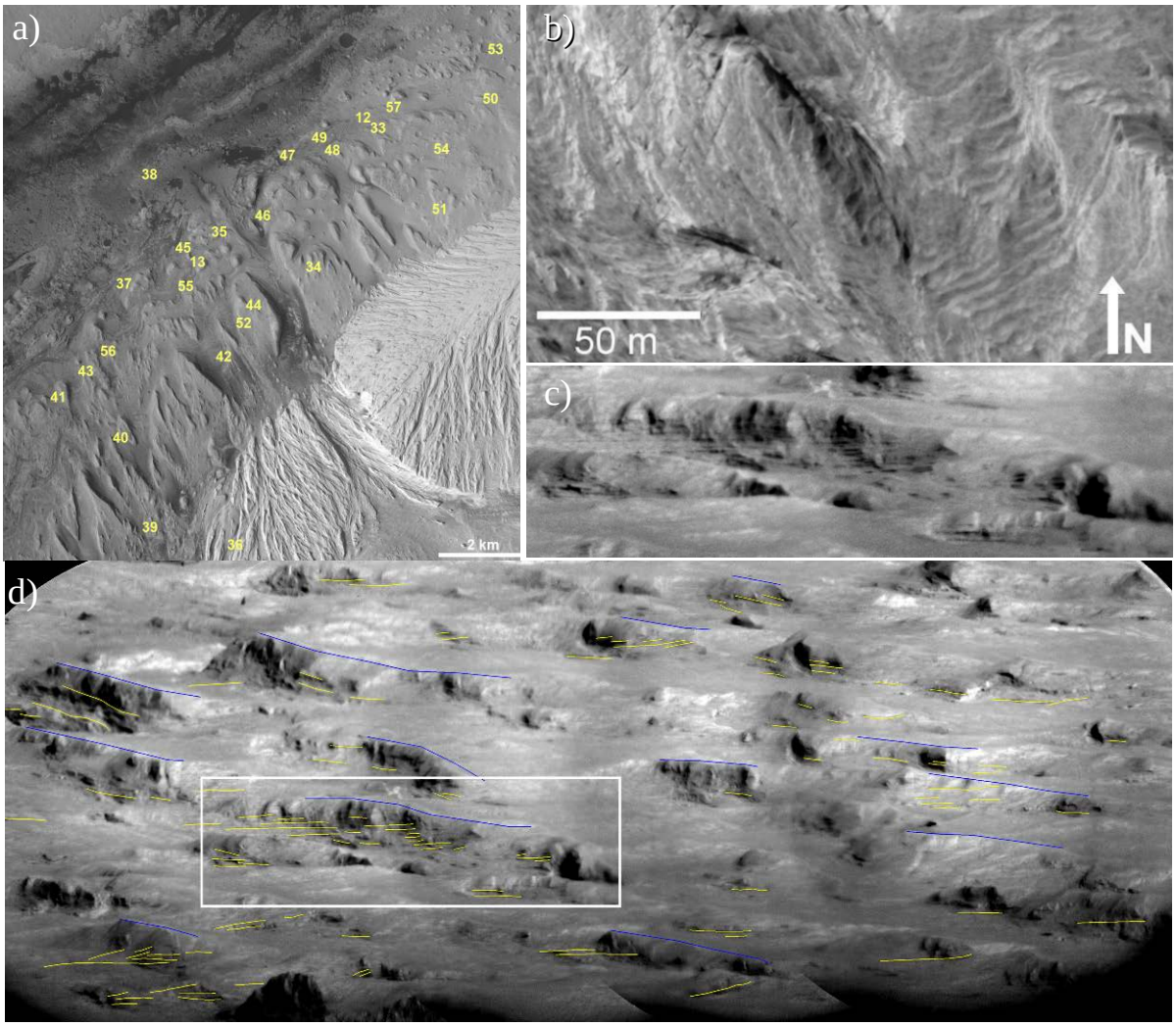

Figure 1: (a) Orbital view showing the light toned yardang forming material (LTY) and locations of lineae identified in HiRISE data [6]. (b) HiRISE view of fine-scale layering in the LTY, from [1]. (PSP_009294_1750) (c) Cropped portion of the sol 1183 RMI mosaic showing fine-scale layering. (d) Sol 1183RMI mosaic, annotated with fine-scale bedding (yellow) and apparent yardang surfaces (blue). Box indicates the inset in (c).

Figure 2: (left) An example viewshed from location #13 in Fig. 1a. The observed lineae will be visible when the rover is in the areas marked with green. The proposed traverse path is indicated by the yellow line. (right) Cumulative viewshed from the proposed traverse, indicating the slopes that will be most (red) and least (blue) visible. Red slopes are good candidates for ongoing monitoring with the RMI.