

LA-UR-20-29903

Approved for public release; distribution is unlimited.

Title: Housedon-Hill – A ChemCam/RMI mega mosaic to investigate distant features

Author(s): Wiens, Roger Craig
Le Mouélic, S.
Gasnault, Olivier
Rapin, William
Bryk, A.
Dromart, G.
Caravaca, G.
Mangold, N.
Newsom, H.

Intended for: Press release

Issued: 2020-12-02

Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Housedon-Hill – A ChemCam/RMI mega mosaic to investigate distant features

Contributed by S. Le Mouélic, O. Gasnault, W. Rapin, A. Bryk, G. Dromart, R. C. Wiens, G. Caravaca, N. Mangold, H. Newsom and many others



Fig. 1: Housedon_Hill ChemCam/RMI mosaic, with selected zooms on areas of interest (*original image file 46947x7260 pixel, 123 MB, <https://uncloud.univ-nantes.fr/index.php/s/gwKWp6wQw5M9cmL>*).

Image credits : NASA/JPL-Caltech/LANL/CNES/CNRS/IRAP/IAS/LPG

An additional video file (508 Mo) can be found here: <https://uncloud.univ-nantes.fr/index.php/s/DwiCpwCqRSqRENm/download>

The ChemCam Remote Microscopic Imager (RMI) onboard Curiosity was originally designed to document the tiny areas analyzed by ChemCam's laser-induced breakdown spectroscopy (LIBS) technique on rocks at few meters distance around the rover. The RMI produces 1024x1024 pixel black and white images directly from ChemCam's telescope focal plane. Early in the mission, it was recognized that, thanks to its powerful optics, RMI could also play a role as a long-distance reconnaissance tool, complementing other cameras on the remote sensing mast, and taking advantage of its very long 700 mm focal length. Imaging areas several kilometers from the rover provides pictures that are very complementary to orbital observations and gives a more human-like, ground-based perspective.

Between sols 2878 and 2921, Curiosity stayed parked at the same place to perform various rock sampling analyses. This opportunity was used to target very distant areas of interest, daily building an RMI mosaic of 216 overlapping images covering an area ranging from the bottom layers of Mount Sharp to the edge of Vera Rubin Ridge. This product is so far the largest RMI mosaic acquired during the entire mission.

Figure 1 shows the images stitched into a resulting 46947x7260 pixel panorama, which covers more than 50 degrees in azimuth. The insets show the very high resolving power achieved by RMI on various geologic landforms, such as a dune field with sand ripples in the vicinity of Vera Rubin Ridge (Figure 2), and a variety of layered units, some with crossbedding, revealing new details on the complex deposition history of sedimentary rocks comprising Mount Sharp.

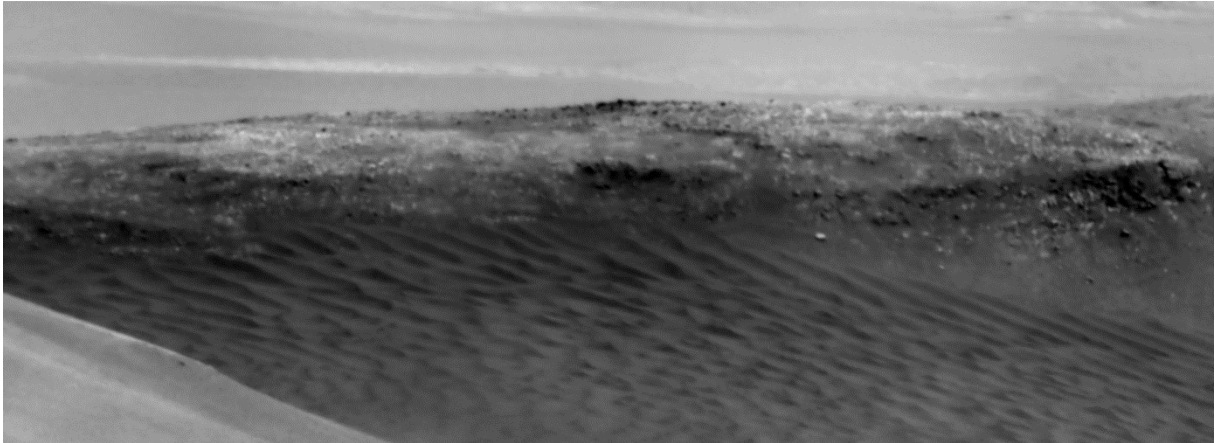


Fig 2: Dune field near at the edge of Vera Rubin Ridge, 2 km away from the rover. The interval between ripple crests is ~ 1 m.

By stretching the contrast of the image in the middle of the panorama above the foreground up to 19 km away, one can recognize features corresponding to large blocky rocks that rolled partway down from Gale's crater wall way off in the distance (Fig. 3 and 4). When compared to orbital imagery, these blocks appear to be 59 km from the rover – a record of distance for a ChemCam/RMI observation. This is the equivalent of seeing Baltimore's downtown buildings from Washington DC's city center. This indicates that despite the dust in the atmosphere, which varies significantly during seasons, the sky at this time was clear enough to perform such distant imaging.



Fig. 3: Exposure of layered rocks in the foreground. The hill at the top center is ~ 20 km away. The light-toned upper background is not the sky, but is actually Gale crater's wall 59 km away, seen through the hazy Mars atmosphere.

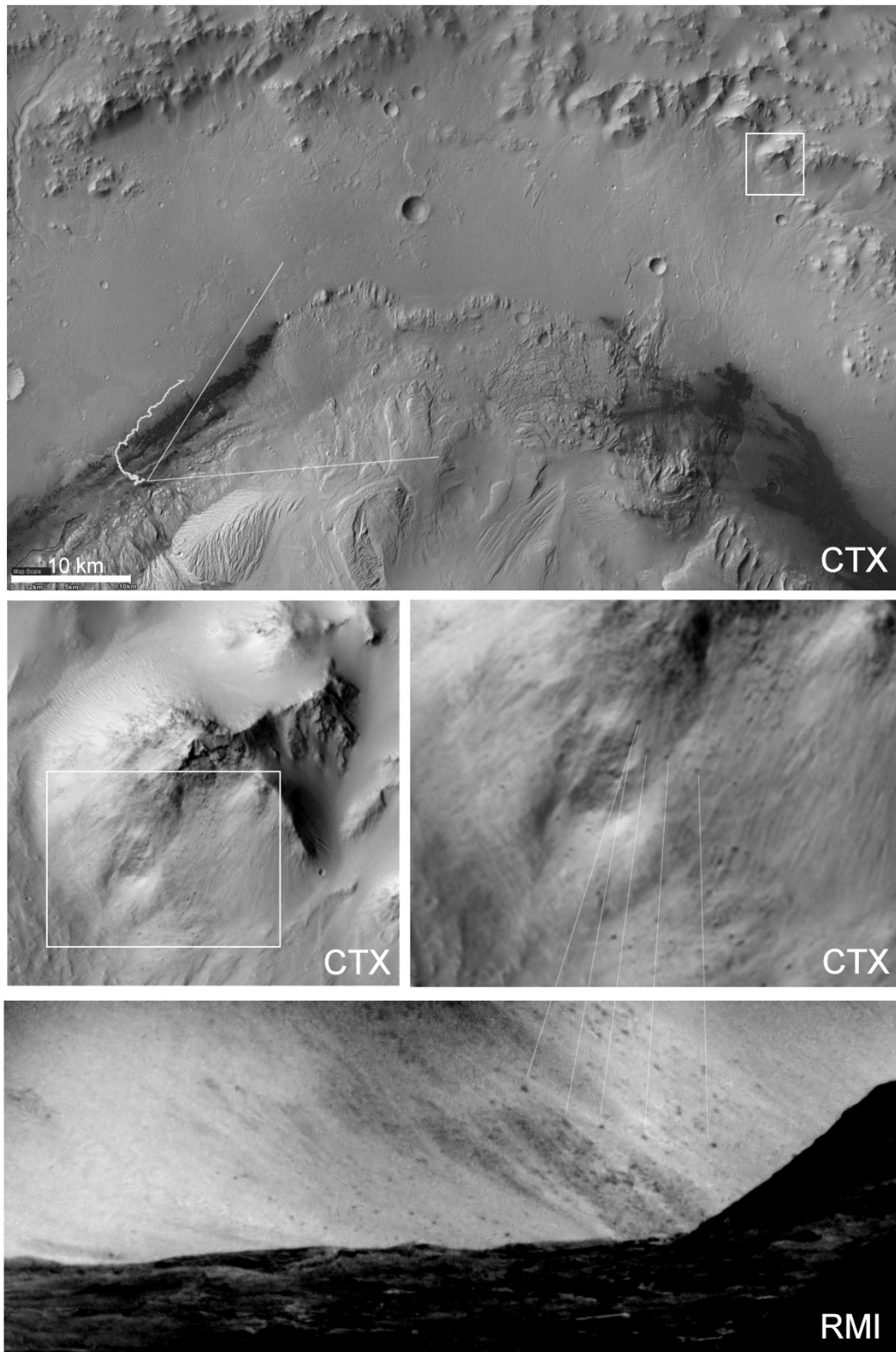


Fig. 4: Context image of the most distant feature seen in the RMI mosaic. The top image is a global CTX mosaic (source <https://mars.nasa.gov/maps/location/?mission=Curiosity>) taken from orbit. The MSL rover's traverse is indicated in white, and the viewshed of the RMI mega-mosaic is indicated from the rover's imaging location. The white box indicates the location of the zoomed-in panels displayed in the middle. Distant rocks fallen partway down from Gale's crater wall are seen as dark specks in both the CTX and the contrast-stretched RMI mosaic (bottom) taken from 59 km away.

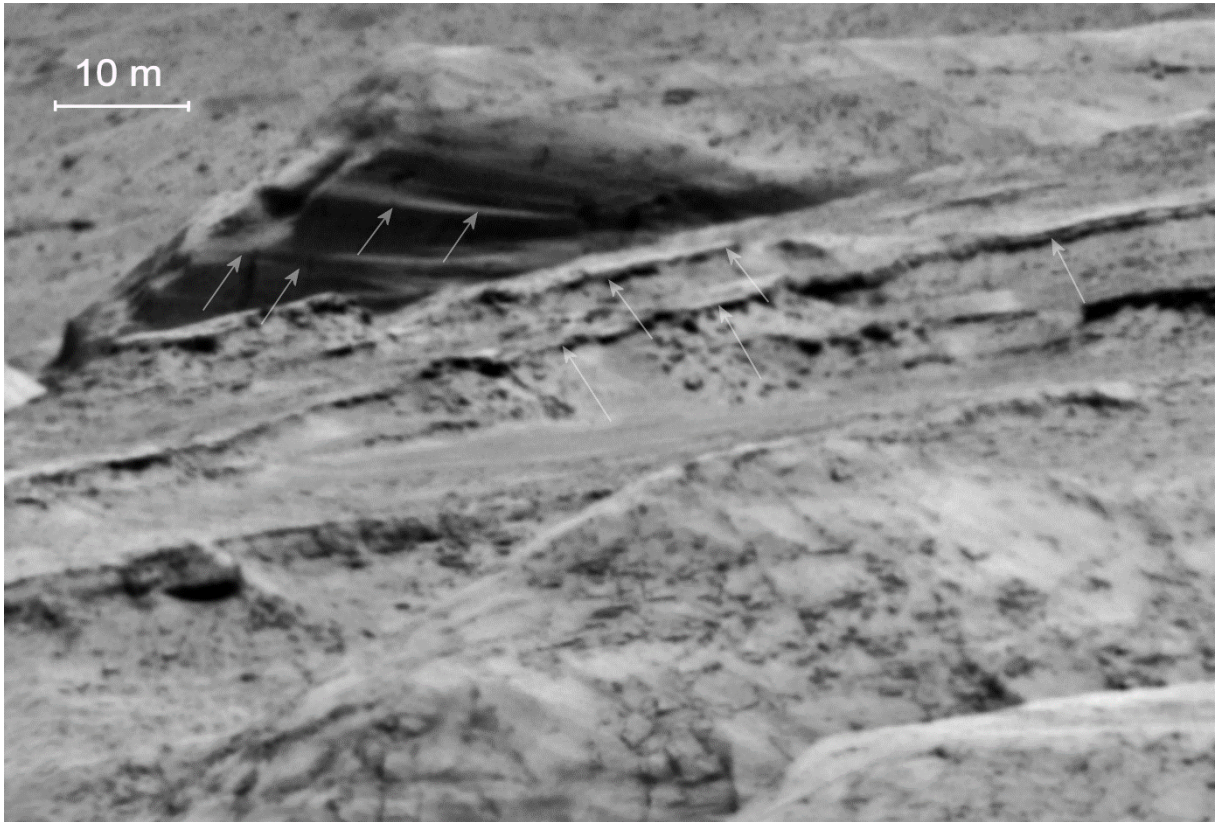


Fig 5: Example of cross bedding. Layers in the front dip from right to left while the layers in the background (at ~7 km from the rover) dip the other way.

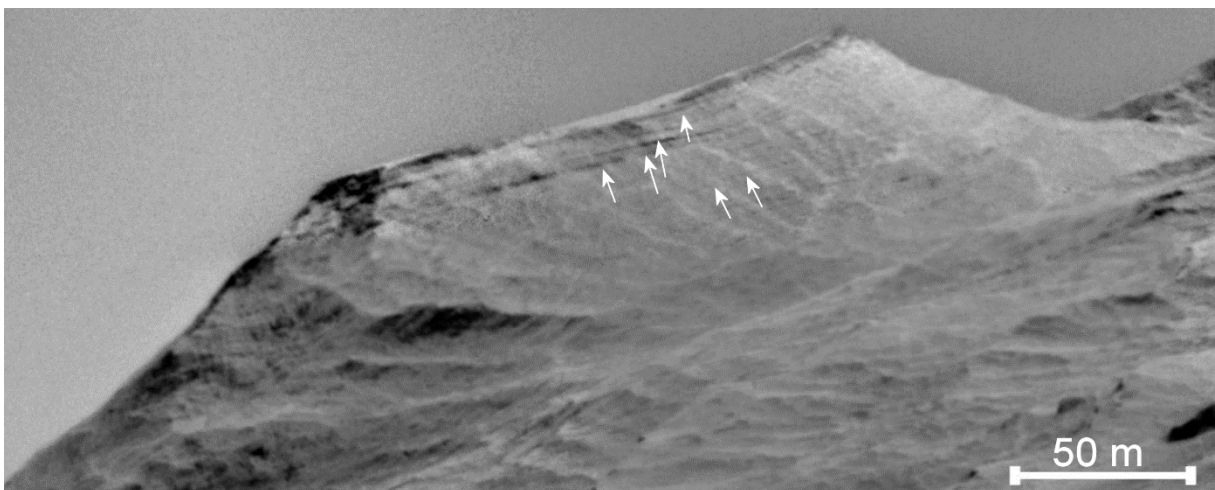


Fig. 6: This mesa feature within the large and chaotic mass-wasting unit of Mt Sharp is seen at 16 km from the rover and shows evidence of fine- meter-scale bedding (arrows).

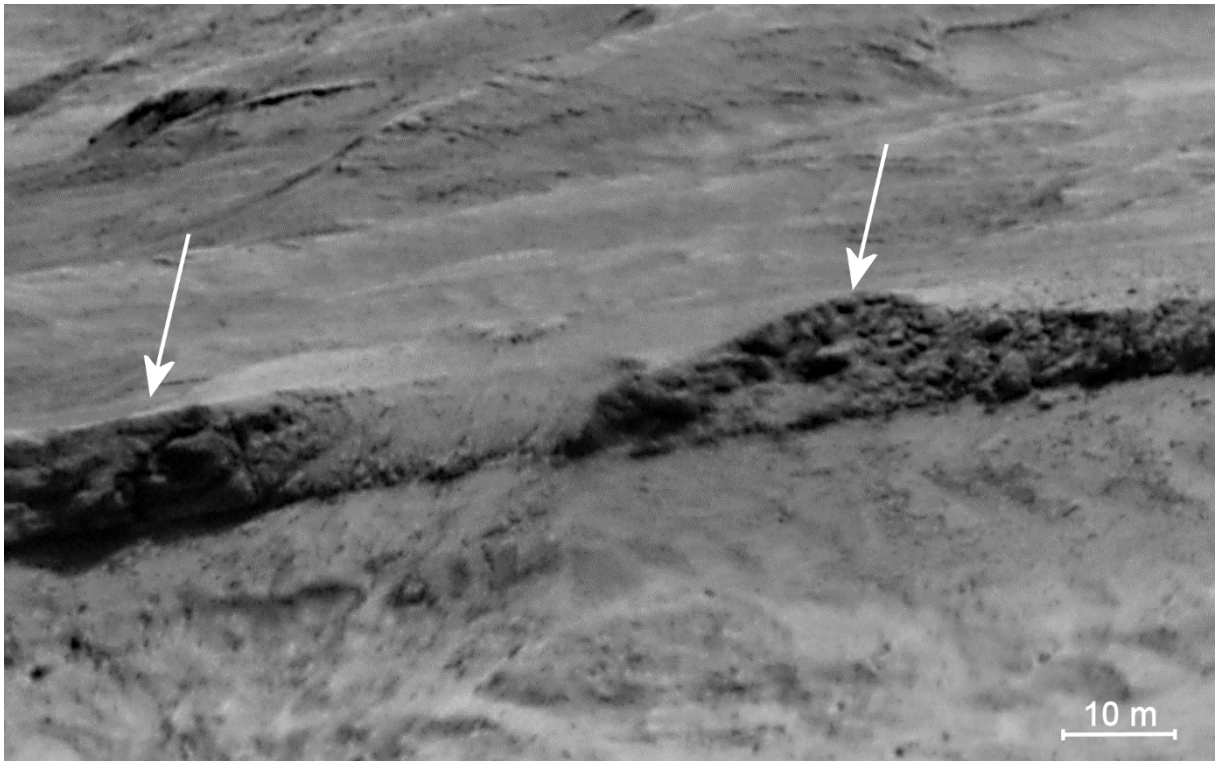


Fig. 7: The erosion-resistant lip identified as a “Marker Bed” transition (~9 km away).

Fig. 7 shows part of the Marker Bed, with its characteristic irregular thickness and blocky morphology. A “Marker bed” is a single layer landform that can be traced across a long distance, connecting sediment formation in one region to formations in distant areas. Mount Sharp has a prominent marker bed that extends almost all along its base, extending over tens of kilometers. It appears as a dark rocky bed of strata that marks a key transition in the ancient depositional environment of the sediments as it marks the upper boundary of the crossbedded interval visible on outcrops such as the ones in Fig. 8.



Fig. 8: Eroded butte within the lower crossbedded section or transition interval.