TRANSVERSE AEOLIAN RIDGES: MARS SPACECRAFT DATA ANALYSES AND A NEW EARTH ANALOG. J. R. Zimbelman[1] and M. Foroutan[2], [1]CEPS/NASM MRC 315, Smithsonian Inst., Washington, D.C. 20013-701 (zimbelmanj@si.edu), [2]Department of Geography, Univ. of Calgary, Canada (foroutam@ucalgary.ca).

Introduction: Transverse Aeolian Ridges (TARs) are perplexing features on Mars whose mechanism of origin remains unresolved. The term refers to bedforms that may have formed either as large ripples or small dunes [1, 2]. New data from spacecraft both in orbit and on the surface provide new insights into the characteristics of TARs on Mars, and recently a new terrestrial analog for Martian TARs was identified in the Lut Desert of Iran [3].

Curiosity at Dingo Gap: The Curiosity rover provided the first in situ observations of a Martian TAR at the traverse location called 'Dingo Gap', where a small TAR was driven across on sol 533 [4]. Prior to Curiosity arriving at Dingo Gap, an aeolian bedform along the intended path for the rover (DG, Fig. 1) was interpreted

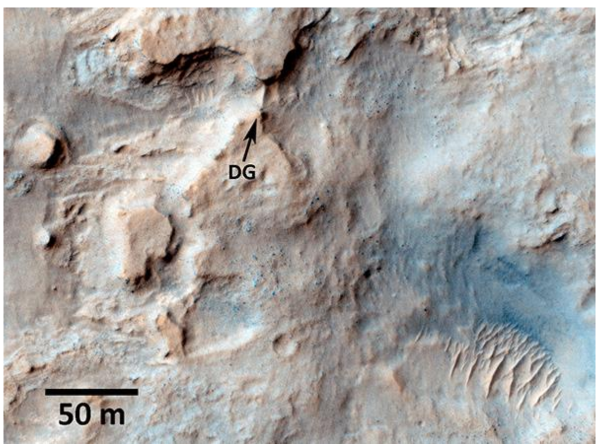

Fig. 1. Portion of HiRISE image ESP_027834_1755, obtained prior to Curiosity landing. Dingo Gap TAR (DG) crosses the entrance a valley along the path to be followed by the rover. Similar TARs at lower right.

as a sand dune [5], although low albedo sand is only visible from orbit by similar TARs SE of the gap (Fig. 1). Following Curiosity's visit, the feature was called a TAR [6], an interpretation we concur with. The sharp-crested bedform is clearly visible as Curiosity approached Dingo Gap (Fig. 2). The dark appearance of

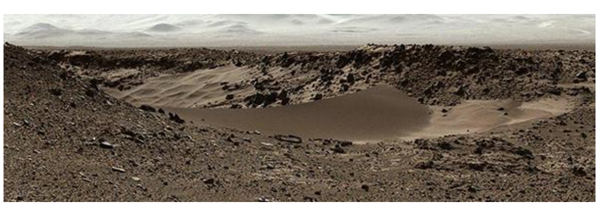

Fig. 2. Portion of MastCam panorama, PIA17766.

The eastern side of the bedform appears relatively dark (Fig. 2), but this could be photometric darkening of a slope facing away from the solar incidence direction rather than a lower albedo. Curiosity assessed the feature before attempting to cross it, obtaining both stereo data with the two NavCams (Fig. 3) and close-up views of the surface using MAHLI (Fig. 4). The surface is

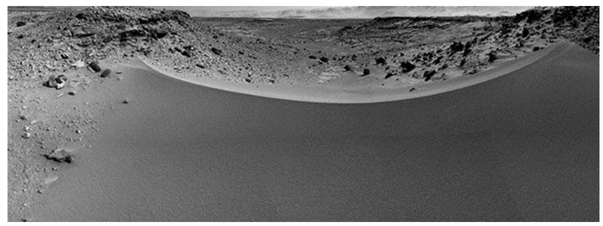

Fig. 3. Portion of NavCam mosaic, PIA17930 (released as a stereo anaglyph).

Fig. 4. Portion of MAHLI image from sol 531, showing mm-size rounded grains armoring the surface of the Digno Gap bedform, all coated by fine dust.

armored by a monolayer of well-rounded mm-scale grains, with the entire surface coated by fine dust; this surface is very similar to that seen on the sand shadow 'Rocknest' [7], except the coarse particles are more closely spaced at Rocknest than at Dingo Gap [6]. Once Curiosity crossed the bedform, dark sand was exposed within the rover wheel tracks (Fig. 5), again similar to the sub-surface characteristics at Rocknest [7]. This observation is at odds with a previous interpretation that the interior of the Dingo Gap feature consisted of fine-grained (<150 μm) material, which is typically higher albedo than dark basaltic sand. We conclude that the good trafficability of Curiosity across

Fig. 5. Portion of MastCam image, sol 538. Rover wheels did not sink more than a few cm when traversing the TAR. Dark sand exposed in tracks.

the Dingo Gap feature is a clear indication that it is distinctly different from the fine-grained interiors of megaripples at Meridiani Planum, which trapped the Opportunity rover for weeks at a time [8]. Engineering data collected by Curiosity while it traversed Dingo Gap provide the first surface topography measurements of a Martian TAR (solid line, Fig. 6), indicating relief

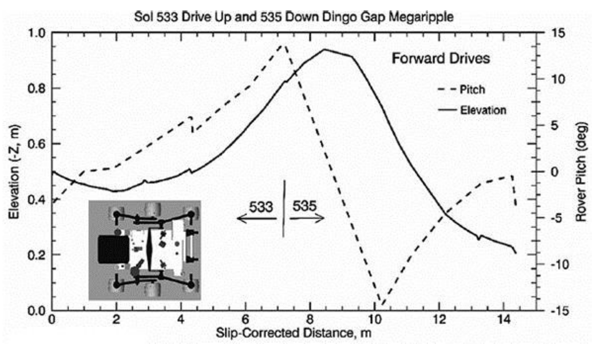

Fig. 6. Topography (solid line) across Dingo Gap TAR from Curiosity engineering data [Fig. 8A of 4].

of ~60 cm for a symmetrically shaped bedform ~12 m in width (note that the rounding of the Curiosity profile is a function of the drive, and not indicative of the sharp crest shown in rover images). The topograhpy at Dingo Gap is similar to values for TARs studied elsewhere on Mars [2]. Recently it was determined that Dingo Gap is the most likely place for surface frost to collect along all of Curiosity's traverse to the base of Mt Sharp [9], consistent with its observed distinctive surface particle size distribution. All of the above information indicates Dingo Gap is the first Martian TAR to be visited by a rover.

New Assessment of TARs on Mars: Recently >100 publicly released Digital Terrain Models (DTMs) of topography derived from stereo HiRISE images were analyzed to obtain morphometric measurements of more than one million TARs distributed widely across the Martian surface [10]. The DTM data provided a comprehensive basis for comparing Martian TARs to megaripples studied on Earth. TAR width, measured between the basal break in slope on both sides of the bedform, ranged from <2 m to ~200 m, greatly expanding the parameter space over which TARs have been documented [10]. The Dingo Gap TAR falls within the width range represented by most TARs on Mars.

TAR-like features in the Lut Desert: A new analog site for TARs was recently identified in the Lut Desert of Iran [3]. Both the planform and the measurable attributes of the TAR-like features in the Lut are better matches to Martian TARs [10] than are previous analogs, such as gravel-mantled megaripples [11] or reversing dunes [12]. M. Foroutan recently visited the Lut site and in the future will present new observations that should improve our ability to compare analog features on Earth to TARs on Mars.

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