STRATIGRAPHY AND TERRACING AT MT. SHARP: ARE THEY ONE AND THE SAME? T. J. Parker¹, R. C. Anderson¹, B. G. Bills¹, Z. E. Gallegos², and Ezat Heydari¹. ¹Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, ²University of New Mexico (zeg@unm.edu), ³Jackson State University, Mississippi.

Introduction: This work is an update of a prediction made in 2015 [1], that the terraces and banding that are prominent in lower Mt Sharp are buttressed deposits against the pre-existing mound that could be compared to strandlines at Lake Mead, Nevada. Today, Curiosity has climbed through much of this banding, providing in situ observations of the stratigraphy and topography that can be compared with field observations at Lake Mead.

Orbiter-Based Observations: In 2015, Curiosity was six years from beginning its ascent of Mt Sharp, so publications up to that time were based solely on orbital observations. The gross physical characteristics of Mt Sharp have been described since before the MSL launch [2–4]. In [1] we described what appeared to be old erosional and depositional surfaces around the mound, that include the “mound-skirting ridge” [4] and the Greenheugh Pediment (Figs 1,2).

Figure 1: Major physiography of lower Mt Sharp and Curiosity ascent route. Sol 3974 location indicated.

Figure 2: Location of Marker Band Valley. Note that Curiosity traverse is almost exclusively on Gediz Vallis channel and fan deposits, and related erosional surfaces. Key outcrops visited by Curiosity labeled in white.

What does Curiosity see? Curiosity’s traverse to date has been entirely through the proposed Gediz Vallis paleofan and strata related to (Fig 2). Many of the cliff exposures show evidence of fluvial sedimentary structures and fine sub-horizontal laminations (lacustrine?) in direct association. Three cliff exposures that appear to coincide with the “sub-pediment” surface are Bolivar, Bela Vista, and Amapa (Fig 2). Amapa, in particular, appears to exhibit steeply north-dipping, undulating bedding crossed by sub-horizontal laminations, that might be the local expression of the “sub-pediment” surface (Fig 4). South of this exposure the cliff exhibits both broad decimeter-scale undulations crossed by fine sub-horizontal laminations just above the Marker Band (Fig 4).

Figure 3: Anaglyph of Roraima Quadrangle viewed from northeast. GVR = Gediz Vallis Ridge. MBV = Marker Band Valley. Two paleosurfaces = Greenheugh Pediment/Mound-skirting Ridge and “sub-pediment” can be traced partway up Gediz Vallis on both sides of the GVR.

Curiosity has only approached one cliff exposure close enough for detailed investigation that is arguably outside the Gediz Vallis influence, and thus possibly representative of Mt Sharp stratigraphy. This knob, Chenepau, displays both the well-defined horizontal laminations and related cliff- and slope-forming bands at a shallow angle to northward-dipping bands (Fig 5).

The northward-dipping bands cross multiple horizontal laminations, so they’re not typical crossbed structures, and may indicate overprinting of these bands by the horizontal laminations.
Recent Relevant Observations: In the past few months, Curiosity’s Remote Microscopic Imager has been used to identify potential strand lines on the bajada surface inside Gale crater’s northern rim [5]. Though corroboration with orbiter and Mastcam 100 data is TBD as of this writing, it might be possible to “pair” them with terraces on Mt Sharp, if vertical separations between proposed strandlines can be correlated with same on Mt Sharp terraces/banding.

Puzzles: Several puzzles need to be addressed:

*If MBV terraces and banding represent stratigraphy within the mound, why weren’t they deformed by burial in upwards of 2000 meters of overburden?

*Why is there little or no talus at bases of the steepest slopes?

*Why do cliff exposures and Marker Band terraces exhibit laminations uninterrupted over tens of meters laterally, when arcuate bands and terraces on gentle slopes exhibit laminations that can be very hard, if not impossible, to trace from one block to another over a few tens of centimeters?

Morphological Similarities to Lake Mead: Good terrestrial analogs to the banding at Mt Sharp have been identified at Lake Mead [1]. The current drought in the southwest US has exposed strandline terraces that have formed since the lake was created in the late 1930s.

Hypothesis:
The marker band and all other sub-horizontal terraces in the lower mound represent strandlines of a Gale crater lake, much younger than Mt Sharp, with sediments derived from reworking of Mt Sharp sulfates and other locally-derived materials. Marker Band Valley is an embayment of this lake into the eroded margin of Mt Sharp.