

MORPHOLOGICAL AND STRATIGRAPHIC COMPARISON OF A RIDGE AT THE “MARKER BAND”, GALE CRATER, WITH A SMALL BAY-MOUTH BAR IN LAKE BONNEVILLE, UTAH. T. J. Parker¹, R. C. Anderson¹, J. Grant², E. Heydari³, ¹Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, ²Center for Earth and Planetary Studies, Smithsonian Inst., ³Jackson State Univ., MS, tjpark@jpl.nasa.gov, tjpark@jpl.nasa.gov.

Introduction: The Curiosity rover has been investigating bedrock exposures on the west side of “Marker Band Valley (MBV), from Nov-Dec, 2022. As of Sol 3690, the rover is just east of a small topographic ridge at the Marker Band (MB Ridge) that separates a small depression west of the ridge with the rest of MBV to the east (Fig. 1). Here, we will compare this ridge to a small lacustrine bay-mouth bar in lake Bonneville on Earth. If this ridge is indeed a bay mouth bar, the implication is that the Marker Band (and perhaps many of the terraces/bands on the flanks of Aeolis Mons) represents a strandline of reworked sediment derived from and buttressed against the mound, rather than stratigraphy within the mound.

Marker Band Valley: MBV (Fig 1) is a topographic embayment on the north slope of Aeolis Mons, where Curiosity first encountered the Marker Band – a smooth, relatively dark terrace that was first identified around the mound in HiRISE images of Gale crater [1].

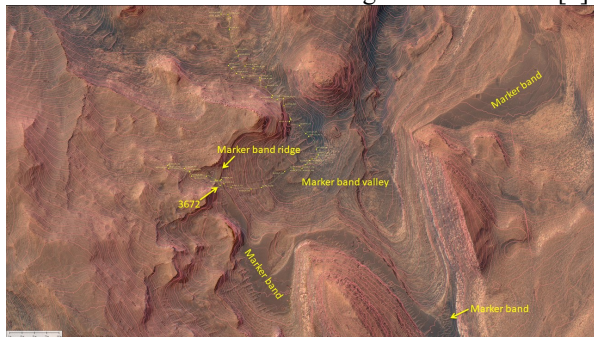


Figure 1: Marker Band Valley. 900x675m HiRISE “ORR/DEM” contoured at 1 meter interval, showing location of Marker Band ridge on west side of valley.

MB Ridge: The MB Ridge is ~35 meters long, trending N-S across a small embayment to its west (Figs 2,3). It is about 1.5m high on its west side, and 3 meters on its east side. Similar structures can be found in terrestrial paleolake settings (Fig 4). The size of these features depends on the sediment supply to the ridge via longshore currents. This ridge appears to close the bay because the catchment area west of the ridge insufficient for downslope erosional processes (fluvial?) to have breached the ridge since its formation.

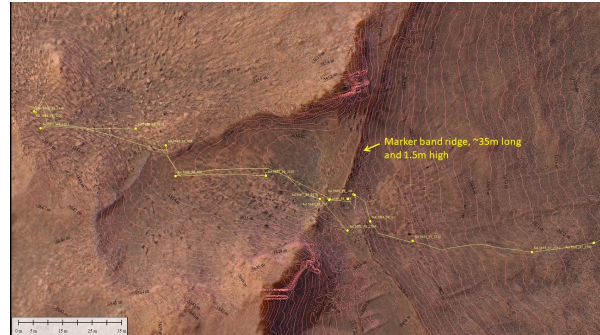


Figure 2: Marker Band Ridge at west side of MBV. Combination Navcam/HiRISE ORR/DEM with Navcam DEM contoured at 50cm interval.

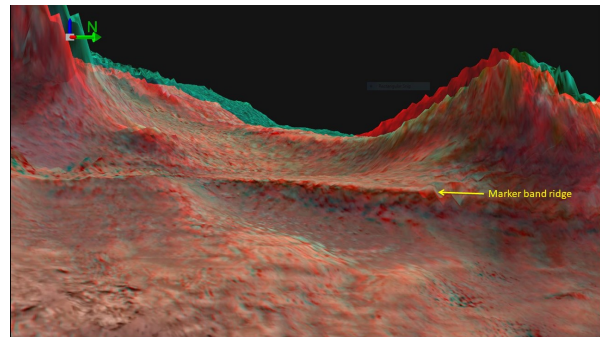


Figure 3: Oblique anaglyph view from E of combined Navcam/HiRISE ORR/DEM, showing enclosed depression beyond ridge to west. 2x vertical exaggeration.

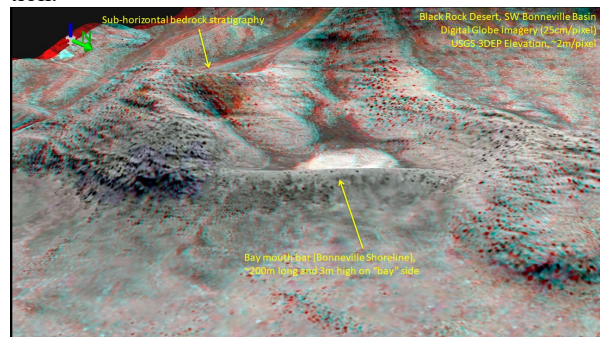


Figure 4: Small bay mouth bar in the Black Rock Desert, UT, in southern Lake Bonneville (38.9N, 112.86W). a) This ridge is ~200m long and 3m tall on its SW side. b) Oblique anaglyph view from NE with 5x vertical exaggeration. Terracing in bedrock is near-horizontal stratigraphy of Paleozoic carbonates, unrelated to the ~15Ka Bonneville shoreline.

Stratigraphy of Marker Band Ridge:

Profiling across the ridge using the Navcam point clouds from 3 rover locations (Fig 5) reveals a gentle eastward slop on the ridge of up to 4 degrees. The east side of the ridge appears undermined, such that ripple-laminated blocks, with ripple crests trending E-W locally, have foundered and tilted downslope. Ripple-laminated blocks that are in place in the ridge appear nearly horizontal. Laminations just west of the east edge of the ridge appear to dip gently toward the WNW, striking parallel to the ridge form. The west side of the ridge is sloped up to 10 degrees WNW, and does not exhibit laminations, perhaps suggesting a dip slope.

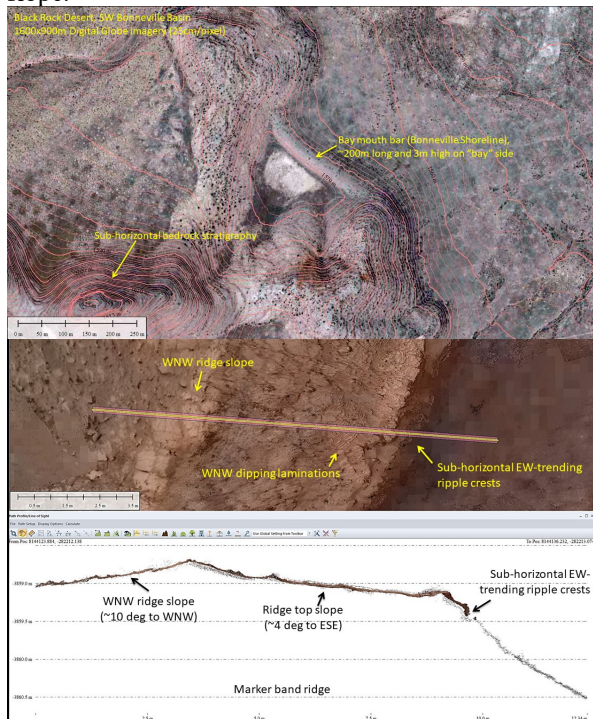


Figure 5: Profile across Navcam 5mm/pixel point cloud of MB ridge (yellow line, with points 10 cm to either side included).

Stratigraphy of a Bonneville spit, east Pavant Butte, Utah: For a possible terrestrial analog to the laminations seen in the MB ridge, we examined a spit that formed on the east, downwind side of Pavant Butte, UT, a basaltic tuff cone that erupted into Lake Bonneville (Fig 6). A modern stream has incised the spit at its head at the Bonneville level, and cuts through the sloping south edge of the spit. Laminations near the crest of the spit exhibit prominent symmetrical beach ripples composed of basaltic sand eroded from the butte by waves. Laminations on the flanks of the spit are largely planar, and dip parallel to the slope.

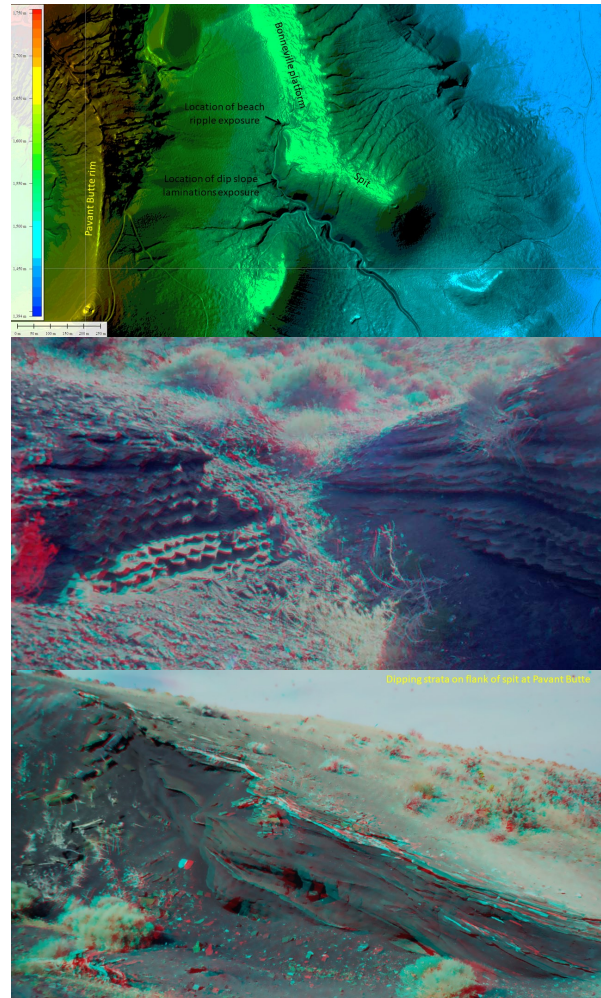


Figure 6: a) DEM of spit on east flank of Pavant Butte, UT (39.1N, 112.5W). b) Anaglyph of beach ripples at Bonneville level. c) Anaglyph of dip-slope laminations on lower flank of spit.

Implications: If the MB ridge is a bay mouth bar, it would seem to have formed via longshore currents from the north bringing eroded and/or reworked material from the mound to close off the small embayment west of the ridge. The WNW dipping laminations could be material deposited in relatively calm waters in the embayment. The modern depression west of the ridge would be a site of non-deposition of MB sediment, rather than an erosional feature. If this interpretation is correct, the MB (and perhaps many of the arcuate terraces on lower Aeolis Mons) represent strand-lines of a receding lake, cut into the flanks of the mound long after formation of the mound and erosion to the current expression, and are not related to stratigraphy within the mound.

References: [1] Milliken R.E. et al. (2010) GRL, 37(4).