
Introduction: Curiosity is currently exploring Glen Torridon, and after finishing characterizing this area the rover will investigate the Greenheugh pediment and the lower Gediz Vallis Ridge (Figures 1, 2). Curiosity will also traverse Gediz Vallis and examine its upper ridge that is characterized by debris filling a central channel (Figure 2). In this abstract we compare these debris deposits to more extensive deposits and evidence of slope-dependent mass movements in the Grand Canyon located on the SW portion of Mount Sharp.

Figure 1: CTX mosaic covering NW Gale crater and its central mound (Aeolis Mons, informally named Mount Sharp) overlain with Curiosity rover’s traverse through sol 2381. Gediz Vallis and Grand Canyon locations are labeled.

Gediz Vallis and the Upper Gediz Vallis Ridge: Gediz Vallis is ~10 km long, ~0.9 km wide, ~100 m deep, with relatively smooth U-shaped walls and floor, and has been cut into sulfate-bearing strata. A central ridge extends from the upper portion of the valley, merging with the lower ridge on the Greenheugh pediment [3]. The upper valley ridge fills a ~0.9 km wide central valley and has relief above the valley floor ranging from ~3 m to ~20 m. CRISM and HiRISE data show that the debris is a poorly sorted mix of polyhydrated sulfate and basaltic materials, including polyhydrated blocks as large as ~20 m [2].

Grand Canyon: The Grand Canyon is ~35 km long, ~1.8 km wide, and ~250 m deep. This valley is V-shaped on its upper reaches, transitioning to a more U-shaped on the distal portion. The valley is cut into a mix of monohydrated and polyhydrated sulfate-bearing strata, with the floor rocks dominated by monohydrated sulfate bearing deposits (Figure 3). The floor in many areas is covered by debris deposits that based on HiRISE images appear to have been differentially eroded to expose various strata. Debris is poorly sorted with “boulders” extending up to ~20 m in diameter. Basaltic sands cover the deposits in some areas. These deposits are dominated by polyhydrated and basaltic signatures (Figure 4). In areas, the deposits are clearly distal portions of mass movement events with sources from the valley walls. In these cases debris is evident extending down into the valley floor (Figure 5).

Figure 2: CRISM-based mineral absorption parameters [1] are color coded and overlain onto a HiRISE DEM-based shaded relief map. The parameters show the change from hydrated phases in Glen Torridon to mixed monohydrated (red areas) and polyhydrated (yellow areas) sulfate-bearing strata to the south (e.g., higher up on Mount Sharp) [2]. Blue areas are dominated by basaltic sand. The white box shows the location of the HiRISE image segment covering the upper Gediz Vallis ridge (UGVR) shown in Fig. 6. The lower Gediz Vallis ridge (LGVR) is also labeled. Curiosity’s
traverse to sol 2381 is labeled. CRISM data from FRT0000B6F1.

**Figure 3:** CRISM-based mineral absorption parameters used in Figure 2 are shown overlain onto the HiRISE mosaic for a portion of the Grand Canyon. White box shows enlargement shown in Figures 4 and 5. CRISM data from FRT000095EE.

**Figure 4:** Closer view of the debris deposits within the Grand Canyon shown in Fig. 3. The white box shows the location of the HiRISE image segment shown in Fig. 6. The debris deposits are dominated by a polyhydrated signature mixed with a basaltic signature.

**Discussion:** The similarities in debris deposits within Gediz Vallis and the Grand Canyon imply similar processes have been at work. We surmise that the Grand Canyon mass movements left distinct debris deposits and that similar processes produces the Gediz Vallis transverse ridge, which appears to be an erosional remnant. This may be a consequence of the relative ages of the two valleys, and/or perhaps the locations of the features relative to wind-action and consequent erosion. A greater extent of valley erosion may have removed mass movement scars and some of the debris deposits in Gediz Vallis, leaving behind only debris in the central valley. We are currently investigating similar landscapes and deposits in terrestrial systems, including glacial areas such as the Himalayas, as well as other valley systems in Mount Sharp. We are also modeling the dynamics of mass movements, given the slopes and appearances of the features evident in the Grand Canyon. The objective is to understand the dominance of polyhydrated sulfate-bearing and basaltic materials in the debris deposits, the role of water and ice in formation, and the temporal evolution of Gediz Vallis landforms and deposits.

**Figure 5:** HiRISE image segment showing two mass movement events with debris extending downhill. HiRISE scenes esp_044726_1750_red and esp_044726_1750_color are shown.

**Figure 6:** Left: HiRISE red and color images over a debris deposit in Grand Canyon (esp_041192_1750_red and esp_041192_1750_color). Right: HiRISE image over the upper Gediz Vallis ridge (esp_052387_1750_red).