
96-21 - THE ROLE OF FAULT DAMAGE ZONE DEVELOPMENT IN STRUCTURALLY CONTROLLED LANDSCAPE EVOLUTION, SEVIER FAULT ZONE, SOUTHERN UTAH



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8:00 AM - 5:30 PM



Hall B (2, David L Lawrence Convention Center)

Booth No. 58

Abstract

The relationships between fault systems, weathering, and erosion strongly affect how local landscapes evolve. Fault damage zones, characterized by intense fracturing in the surrounding lithology, form as faults propagate. The Sevier normal fault, located in southern Utah, consists of several linked fault segments. We focused on the Spencer Bench segment, which displaces the Jurassic Navajo Sandstone. Because the Navajo Sandstone is located on both sides of the fault, we hold lithology constant to evaluate differences in damage zone distribution and resulting impacts on erosional processes. In addition, the headward erosion process permits us to use down-drainage cross-drainage profiles as temporal snapshots of valley hillslope evolution in order to evaluate how damage zone fracturing affects valley evolution.

We collected structural data including fracture orientation and spacing, and we used an Unmanned Aerial Vehicle to capture imagery of inaccessible outcrops. We used this imagery to construct virtual outcrop models from which we collected additional structural data. We documented fracture characteristics in the footwall and hanging wall and compared fracture intensity to topography. Cross-sectional topographic profiles constructed perpendicular to the Spencer Bench fault revealed correlations between structural data and slope. Near the uppermost reach of the fault-parallel canyon to the north, representing youthful valley erosion, the topographic profiles are relatively symmetric, with the slope of the hanging wall and footwall being similar ($\sim 37^\circ$ and $\sim 40^\circ$, respectively), and at the southern end of the canyon, which in our model represents a more mature landscape, the slopes of the hanging and footwall are $\sim 23^\circ$ and $\sim 57^\circ$, respectively. As expected, this asymmetry is reflected in fracture intensity data, where fracture spacing is only ~ 1.4 m in the hanging wall relative to ~ 9.1 m in the footwall. Thus, we hypothesize that the evolution fault-controlled landscapes are strongly impacted by damage zone development, where fracturing associated with fault propagation and slip accumulation leads to the development of the fault-parallel valley, and the asymmetry in damage zone development will lead to an asymmetry in slope, with shallower slopes associated with higher fracture intensity.

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