
101-9 - Booth No. 35: CONSTRAINING FAULT DAMAGE ZONE EVOLUTION WITHIN THE SEVIER NORMAL FAULT SYSTEM, SOUTHERN UTAH



Monday, September 23, 2024



8:00 AM - 5:30 PM



Hall D (Anaheim Convention Center)

Booth No. 35

Abstract

As a normal fault propagates and accumulates displacement, strain affects the rock adjacent to the fault plane, creating a damage zone envelope commonly characterized by intense fracturing. Past researchers have documented the spatial distribution and character of fracturing within damage zones, classifying fracture formation based on structural position, including fault wall, fault tip, and segment-linking damage zones.

In this study, we focused our investigation on the central Sevier normal fault system in southern Utah, where erosion has exposed damage zones formed in a variety of structural settings. We document damage zone fracture networks in the hanging wall and footwall of isolated fault segments, in linking zones between segments, and proximal to fault tips. Because fracture networks help control subsurface fluid flow, investigations like this have implications for groundwater flow, geothermal energy production, and oil and gas exploration and production.

We gathered data via ground-based scanline surveys (documenting fracture orientation, position, and geometry), field photos and sketches, and by capturing imagery of inaccessible terrain using unmanned aerial vehicle (UAV) flights. We use this imagery and Structure from Motion (SfM) software to generate high-resolution, georeferenced 3D models of the ground surface. We use all data to analyze fracture orientation, spacing, and intensity relative to documented faults.

Our data reveal that fault damage zone development is asymmetric within the Navajo Sandstone, with a wider damage zone in the hanging wall relative to the footwall of the same lithology. Our data also reveal a power-law relationship between accumulated displacement and the increase in damage zone width, where it appears that the rate of increase in damage zone width decreases with increasing fault displacement. Where the Cretaceous Tropic Shale in the hanging wall is juxtaposed with the Jurassic Navajo Sandstone in the footwall, fracturing dominates strain accommodation in the sandstone and folding dominates in the shale. We also demonstrate that damage zone development in a well-exposed fault-tip zone overprints a vertical, NE-striking regional fracture set. These results can be applied to similar fault systems in the subsurface to target locations for enhanced permeability across a variety of industries.

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