

53-6 - INVESTIGATING NORMAL FAULT DAMAGE ZONE DEVELOPMENT USING VIRTUAL OUTCROP MODELS: A CASE STUDY OF THE SEVIER NORMAL FAULT, SOUTHERN UTAH



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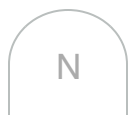
Abstract

Fault-tip damage zones develop in response to fault propagation and displacement and are caused by the local amplification of stresses at the fault tip. Fractures initiate as a result of stresses exceeding rock strength and propagate based on the stress field at the fault tip. We investigate the damage zone of the Spencer Bench segment within the NNE-striking Sevier normal fault near Orderville, Utah, focusing on fractures that developed within the Jurassic Navajo Sandstone, the Temple Cap Formation, and the oldest beds of the Carmel Formation. Because normal faults grow laterally as slip and displacement increase, we focus on the tip zone of a fault segment where fracturing is well-exposed. We executed a series of unmanned-aerial-vehicle (UAV) flights to capture high-resolution imagery of inaccessible rock exposures. We use these images to construct structure-from-motion (SfM) virtual outcrop models (VOMs) that we georeference and analyze using *Agisoft Metashape*. We collected and analyzed fracture orientation and intensity data on the VOMs and combined it with field measurements. Data reveal asymmetric fracture intensity distribution proximal to the fault, with higher intensity in the hanging wall relative to the footwall. This damage zone asymmetry is consistent with previous studies of damage zones proximal to normal faults. High fracture intensity in the hanging wall ends ~30 m from the fault, where lower fracture intensity values are similar to those closest to the fault in the footwall. Along strike of the fault, intense fracturing ends ~60 m to the south and all fracturing ends ~350 m to the south of the fault tip. Our results have implications for the spatial distribution of fracturing in similar normal fault systems. Understanding the geometry and intensity of damage zones is crucial for evaluating earthquake hazards and assessing the potentials of oil and gas production, geothermal energy, and groundwater resources.

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