96-15 - THE EVOLUTION OF FAULT DAMAGE ZONES WITHIN THE SEVIER NORMAL FAULT SYSTEM, UTAH

Monday, 16 October 2023

8:00 AM - 5:30 PM

Hall B (2, David L Lawrence Convention Center)

Booth No. 52

Abstract

Understanding the development and geometry of fault damage zones is important because these fracture networks control subsurface fluid flow and add to our knowledge of fault dynamics and landscape evolution. We examine the dimensions of and fracture intensity within damage zones in the Jurassic Navajo Sandstone associated with the Orderville Salient of the Sevier normal fault system in southern Utah. The Orderville Salient is a zone of complex fault linkage where well-exposed damage zones formed in a variety of structural settings. We surveyed damage zone fracture networks in the hanging wall and footwall of isolated fault segments as well as in fault blocks between segments. We gathered data via ground-based scanline surveys as well as using Structure from Motion (SfM) software to generate 3D models of the ground surface from imagery captured by unmanned aerial vehicle (UAV) flights. We used both scanline and 3D model data to analyze fracture orientation, spacing and intensity. Our data show that there is asymmetry in the dominant fracture orientation across the fault – with the dominant fracture set striking ESE in the hanging wall and SSW in the footwall – as well as asymmetry in damage zone width, with the hanging wall damage zone being ~2.5 times wider than in the footwall. We also find that the footwall damage zone can be divided into an inner zone (~5m wide) and outer zone (~40m wide) based on fracture intensity and resulting topographical development, which is consistent with previous research on fault systems in similar lithologies. In our comparisons of footwall damage zone widths within the Navajo Sandstone, we found widths ranging from ~34m to 44m, meaning that the width does not vary significantly based on fault displacement. This work has implications for fields including groundwater, geothermal energy, and oil and gas production, because the intensity and orientation of fractures in a fault system control the movement of subsurface fluids. Our work can also be applied to understanding the impacts of fault dynamics on landscape evolution.

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