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# New Challenges for Seismic Hazard Characterization of the Cheraw Fault, Southeast Colorado, USA

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The Cheraw fault is one of the few faults within the Central and Eastern United States (CEUS) of North America known to have experienced a surface rupturing earthquake in the Holocene. Despite this unique attribute, it has remained relatively under-characterized and unstudied. Crone et al. [1] mapped a 45-km-long scarp, and based on a single trench found three surface ruptures since 20-25 ka, and suggested the prior interseismic period extended to at least 100 ka. That initial work has been the basis of seismic hazard characterization of the Cheraw fault for nearly 2 decades. However, with new constraints from mapping and DEM interpretations, shallow geophysical surveys and boreholes, combined with interpretation of reprocessed industry 2D seismic reflection profiles, we can show: 1) the Cheraw fault extends an additional 16 km from its previously mapped northern termination, for a minimum total Quaternary rupture length of ~61 km, 2) the ~3 m offset of an early (?) Quaternary pediment along the northeast extension near the town of Haswell, is similar in magnitude to the post 20-25 ka offset of a late Pleistocene channel reported by Crone et al. [1] along the main trace of the fault, 3) seven 2D seismic reflection lines show that the fault extends at least to depths of 2 to 3 km into lower Paleozoic strata and crystalline basement rock as a steep, discrete zone with a dip near 75°, 4) the surface fault trace is a reactivated structure, within a broader and complex zone with multiple periods of Paleozoic to late Cenozoic deformation, and 5) despite the existence of a numerous sinkholes and closed depression in the region, and Permian evaporates below the fault trace, Quaternary surface faulting is not related to dissolution within the evaporate section, and the fault extends as a planar fault to fully seismogenic depths. The seismic reflection data provide vertical offset estimates for early Cenozoic units that can be compared to geomorphic scarp height and offset estimates for Quaternary datums along the fault. Key implications of these new data for seismic hazard models include large disparities in slip estimates derived from geomorphic vs. stratigraphic datums, greater fault length and steeper dip than previously used, along with a range of new hypothesis for event behaviour and slip rate. Among these, the potential that the entire late Cenozoic paleoseismic history of the Cheraw fault is represented by three events since 20-25 ka.

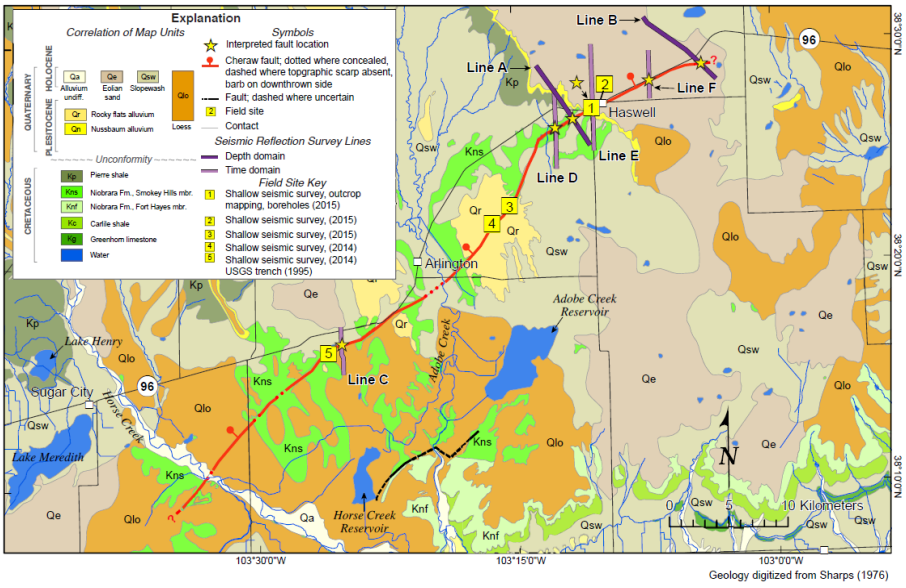


*Figure 1: Geologic map of the Cheraw fault area showing investigation sites and locations of subsurface information.*

*References:*

[1] Crone, AJ, Machette, MN, Bradley, L, and Mahan, SA (1997) US Geol. Surv. Map I-2591 1 sheet and 7 p. pamphlet