Spatial Analysis of the Summerville Fault, South Carolina

Peter J. Hutchinson, THG Geophysics, Ltd.
Jana Bridwell, LeStats Associates
Lisa Schleicher, Independent Geophysicist, now at the USGS

A spatial analysis of the epicenter of over 300 recorded micro-seismic events centered around Summerville, South Carolina suggests that the fault that triggered the Charleston 1886 earthquake and other micro-seismic events is oriented N70ºE and dips N20ºW. The fault, termed here the Summerville Fault to distinguish this interpretation from the work of others, is considered to be a reverse fault. Through this spatial analysis, the epicenter of the 1886 earthquake is interpreted to be located 6 km south-southeast of Summerville, South Carolina.

The shallowest hypocenter associated with the Summerville Fault is located approximately 2 kilometers below grade placing the fault within the Proterozoic. The Clubhouse Crossroads corehole #1, located approximately 30 km, southwest penetrated Cretaceous-aged deposits at 137 m below grade; thus, at a minimum of 700 m below the base of the Cretaceous-aged deposits, places the shallowest hypocenter within the Proterozoic-aged rock. Consequently, this fault is not within the extensional environment (i.e., normal or growth faulting) associated with subsidence of the overburden within the Phanerozoic- to Cenozoic-aged sediments. The Atlantic spreading center is pushing the oceanic crust setting up a compressive environment within the continental crust. The strain associated with this compressive stress has stimulated reverse faulting on the Summerville fault.

These data and interpretations from this study offer new information to consider regarding the parameters used to characterize the Charleston seismic source in the Central and Eastern United States Seismic Source Model. Further analysis may be needed to assess the potential for the results of this study to impact the expected earthquake ground motions at nuclear facilities (and other critical infrastructure) where the Charleston seismic source contributes significantly to the seismic hazard.