# Joint Dinner Meeting

*The Carolinas Section of the*
*Association of Environmental & Engineering Geologists*
*and*

*The Western Branch, North Carolina Section of the*
*American Society of Civil Engineers*

Guest Speaker: **Mark W. Carter, P.G.**



## Presentation:

*The 9 August 2020 Mw5.1 Sparta, North Carolina earthquake:*
*Two Years On*

Dinner and Talk: 5:30-9:00 PM
Wednesday, September 28, 2022
The Wedge at Foundy Street, Cloud Room

# Mark's Abstract:

Mark Carter, Arthur Merschat, Will Odom, Paula Fiqueiredo, Kevin Stewart, Ashley Lynn

The 9 August 2020 $M_w$5.1 Sparta earthquake in northwestern North Carolina caused 10s of millions USD in structural damage to homes, businesses, and infrastructure, and produced the first documented co-seismic surface rupture from an eastern US earthquake.  Immediately following the quake, the USGS and collaborators began a multiyear geologic mapping effort and commensurate paleoseismic studies.  Four km of surface rupture was documented from foot traverses, aerial photography, and LiDAR-derived hillshade images.  The rupture (Little River fault) is a reverse/thrust fault oriented ~115°/45° with top-to-N displacement.  Measured scarp height ranges from 4-50 cm.  Pre-and post-quake LiDAR-derived DEM analysis demonstrates an uplifted surface area of ~11 km$^2$.  The Little River fault cross-cuts regional Paleozoic stratigraphy (Ashe and Alligator Back Metamorphic Suites) and SW-NE-oriented fabric in the eastern Blue Ridge.  Trenches dug across the rupture for paleoseismic studies, and detailed geologic mapping in the meizoseismal area indicate that the Little River fault reactivated an older fault zone in bedrock.  These older faults rotate Paleozoic foliation in the bedrock and are marked by cm-thick zones of breccia, clayey fault gouge, and mm-thick manganese-coated slickenlined fractures.  One of these brittle fault segments is overlain by a terrace deposit that yielded an $^{26}$Al/$^{10}$Be isochron burial age of $0.49 \pm 0.14$ Ma.  The older fault zone has now been traced for ~4 km beyond the length of the surface scarp and, if reactivated, could produce a quake much larger than $M_w$5.1.  The Little River fault and many other newly documented brittle fault zones in northwestern North Carolina are co-linear to regional topographic lineaments observed in satellite imagery and LiDAR-derived DEM images.  Paleoliquefaction surveys (the first in this region) along the New and Little Rivers, and Brush and Bledsoe Creeks in the meizoseismal area documented soft sediment deformation in the immediate epicentral area (Bledsoe Creek), and to the northwest of the epicentral area along the New River.  These data indicate that the 2020 Sparta quake was not an isolated event in a region generally assumed to be aseismic, but a continuation of protracted seismicity spanning more than 500 kyrs.

# Mark's Bio:

Mark W. Carter has been a professional geologist since 1996.  Mark's expertise is geologic mapping throughout the southern Appalachian crystalline core.  He has produced geologic maps and reports in three states (Tennessee, North Carolina, and Virginia) and from four geologic provinces (Valley and Ridge, Blue

Ridge, Piedmont, Coastal Plain).  As a USGS Research Geologist, he is currently co-project chief of the National Cooperative Geologic Mapping Program Piedmont and Blue Ridge Project.