Can Biomarkers in Non-fossiliferous Chattanooga Shale (Late Devonian) Show Evidence of the Earliest Land Forest on the Southern Appalachian Landmass?

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The Devonian Period is crucial for land plant radiation when first land forests appeared. Although plant fossils are very scattered or nearly absent in the organic matter-rich Upper Devonian Chattanooga Shale, geochemical analysis may record changes of the earliest forests. In the present study, we identified carbon sources for organic matter (OM) in the Chattanooga Shale using organic geochemical and inorganic geochemical proxies. The study outcrop in northeastern Alabama was deposited in coastal waters in the southern Appalachian basin. We observed distinctive lithological features including thinly laminated, fissile, pyritic shale in the lower part and nearly homogeneous, blocky, heavily oxidized black shale in the upper part. Based on conodont fossils, the lower part must be assigned to the Upper *crepida* Zone, which indicates the outcrop is entirely comprised of the Famennian Gassaway Member. Terrestrial OM inputs increase throughout the outcrop, based on an increased proportion of long-chain n-alkanes, i.e., higher terrigenous/aquatic and nC_{27}/nC_{17} values, which coincides with increased abundance of organic rich particles in the upper part through SEM observations. These data reflect the land plants radiated in southern Appalachian basin and became an increasingly important carbon source during the deposition. Correspondingly, the quartz-to-clay ratios and detrital influx proxies (i.e., Ti/Al, Zr/Al, Th/Al, Ti/Sr and Th/U values) increase towards the top of the outcrop. These ratios suggest that the land plant expansions may have intensified terrestrial weathering and contributed to enhanced clastic influx. Furthermore, the presence of combustion derived PAH compounds indicates the occurrences of forest fires accompanying the diversification of early land plants in the Eastern Laurasia.