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The aromatic domains in charcoal are small: Implications for the fate and transport of pyrogenic carbon

W.C Hockaday (1) and C.A Masiello (2)

(1) Baylor University, Waco, TX, United States (william_hockaday@baylor.edu), (2) Rice University, Houston, TX, United States (masiello@rice.edu)

We have applied quantitative carbon-13 nuclear magnetic resonance spectroscopy (NMR) to charcoals produced in the laboratory and in prescribed wildland fires. The NMR experiments quantify the relative abundance of aromatic carbon. Additionally, our dipolar-dephasing NMR experiments quantify the relative abundance of aromatic bridgehead carbons. Together, these NMR data allow us to estimate the average size of the aromatic domains (i.e. number of aromatic carbons per cluster) within the charcoal structure. Charcoals made in the lab and the field consist of small aromatic domains averaging 10 to 30 aromatic carbons per cluster. We compare this information with the molecular formulae for molecules of pyrogenic origin in dissolved organic matter from rivers. Dissolved pyrogenic molecules have similar carbon numbers to the aromatic clusters in charcoal, suggesting that soil processes may mobilize charcoal carbon by cleaving the linkages between aromatic clusters.