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Pyrogenic carbon: influences upon structure and environmental degradation potential

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A key process during global wildfires is conversion of biomass to pyrogenic carbon (PC) by exposure to elevated temperatures in reducing conditions (pyrolysis). PC comprises a continuum of material, including charcoal, soot, and black carbon, in which the carbon content is raised relative to the starting biomass and exists in highly stable aromatic configurations. Components of PC therefore display greater resistance to environmental degradation than non-pyrolysed biomass, and are apparently not readily re-oxidized to CO_2 over geological timescales (Levine, 1991). However, some components of PC apparently undergo environmental degradation on shorter timescales - for example, the loss of PC in a Zimbabwean soil on the order of decades (Bird *et al*., 1999), and complete degradation of PC at an Australian archaeological site (Bird *et al*., 2002).

Present global production of PC from biomass burning is estimated at 50-270 Gt yr^{-1} (Kuhlbusch and Crutzen, 1995), meaning that PC plays a central role in global carbon budgets. Crucial research questions are therefore; how to quantify the stability of PC within a range of environments, and by what mechanisms may PC undergo environmental alteration and degradation? We address these questions by analysis of a wide range of PC material, including samples produced in controlled laboratory conditions, and material obtained from natural deposits up to 50,000 years old. We observe that the ‘degradability’ of PC is likely to be a function of the material itself as well as local

environmental conditions, and suggest future directions for the analysis of PC.