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Tracing pyrogenic carbon suspended in rivers on a global scale

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Combustion-derived, pyrogenic carbon (PyC) is a persistent organic carbon fraction. Due to its aromatic and condensed nature (Wiedemeier et al., 2015), it is relatively resistant against chemical and biological degradation in the environment, leading to a comparatively slow turnover, which would support carbon sequestration. PyC is produced on large scales (hundreds of teragrams) in biomass burning events such as wildfires, and by combustion of fossil fuel in industry and traffic.

PyC is an inherently terrestrial product and thus has predominantly been investigated in soils and the atmosphere. Much fewer studies are available about the subsequent transport of PyC to rivers and oceans. Recently, awareness has been rising about the mobility of PyC from terrestrial to marine systems and its fate in coastal and abyssal sediments was recognized (Mitra et al, 2013). It is therefore crucial to extend our knowledge about the PyC cycle by tracing PyC through all environmental compartments. By comparing its biogeochemical behavior and budgets to that of other forms of organic carbon, it will eventually be possible to elucidate PyC's total spatiotemporal contribution to carbon sequestration.

In this study, we use a state-of-the-art PyC molecular marker method (Wiedemeier et al., 2013, Gierga et al., 2014) to trace quantity, quality as well as 13C and 14C signature of PyC in selected major river systems around the globe (Godavari, Yellow, Danube, Fraser, Mackenzie and Yukon river). Different size fractions of particulate suspended sediment are analyzed and compared across a north-south gradient. Previous studies suggested a distinct relationship between the 14C age of plant-derived suspended carbon and the latitude of the river system, indicating slower cycling of plant biomarkers in higher latitudes. We discuss this pattern with respect to PyC, its isotopic signature and quality and the resulting implications for the global carbon and PyC cycle.

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