Perylene imparts an estimate for the age of terrigenous organic matter in sediments

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Biological productivity on land provides a critical load of organic matter to aquatic sediments. However, the relative proportion of terrestrial and aquatic organic matter in sediments has proven very challenging to constrain. Recent findings suggest that there is a time lag between the production of biomass, its mobilization from terrestrial environments and the subsequent burial in aquatic depocenter. This reservoir age effect substantially complicates the use of natural abundance radiocarbon to apportion the source of organic matter at the 'bulk' level to either terrigenous or aquatic origin.

We identified the polycyclic aromatic hydrocarbon (PAH) perylene – a compound know to have a biological source – as a useful marker to estimate the age of terrigenous organic matter. Although perylene often co-occurs with other more "pollutant" type PAHs, its contrasted abundance profiles in sedimentary sequences suggests a provenance other than fossil fuels and fire. Instead, after decades of ambiguity, a thorough study identified a fungal species [1] living in ectomycorrhizal associations with woody plants [2] *Cenococcum geophilum* — as the prime source of perylene. A marker that represents the 'hot spot' of biological activity, the rhizosphere, would have the great potential to complement the above ground vascular plant markers 'leaf waxes' and may provide important insights into the trajectory of organic compounds from land to oceans. However, the usability of perylene as a marker of soil-derived organic matter needs to be unambiguously established.

To achieve this, we evaluate a high-temporal resolution record of perylene from the anoxic sediments of Pettaquamscutt River, RI, USA over the last 250 years and compare 'bulk' and other source-specific terrestrial markers, including combustion tracers and plant waxes from the same core. Our preliminary findings suggest that perylene can be useful to reconstruct past land-use change on ecosystem scale.

[1] Itoh *et al.*(2012), *Geochim Cosmochim Acta* 95*, 241-251*
[2] Obase *et al.*(2017), *Ecology Stud* 230, Springer, 299-317