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Organic carbon flux and composition in large Southeast Asian rivers

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The continental organic carbon (OC) cycle plays an important role in controlling atmospheric CO_2 and O_2 concentrations, and thus Earth's climate and habitability. The flux and composition of organic carbon carried by world's major rivers yields insights on the sources, storage, and cycling of OC over large, globally-relevant spatial scales.

Here, we present a synthesis of a large number of particular organic carbon (POC) geochemical analyses from the suspended sediments and bedloads of the Irrawaddy, Salween, and Mekong rivers in Southeast Asia. Ramped-pyrolysis (RPO) analyses reveal a wide range of POC thermal reactivities (represented as activation energy Ea). 56-78% of riverine POC has Ea in the 150-220 kJ/mol range, suggesting it is comprised of 1) partly degraded mineral-protected biospheric component (OC_{bio}), 2) partly weathered petrogenic component (OC_{petro}), or a combination of these two. We also found a significant extremely refractive OC_{petro} component (Ea>250 kJ/mol) in bedloads of these rivers.

Finally, we combine RPO with stable ($\delta^{13}C$, $\delta^{15}N$) and radiocarbon (^{14}C) isotope measurements of bulk POC to quantitatively unmix the different fresh and aged OC_{bio} and OC_{petro} components contributing to riverine POC. We present OC_{bio} and OC_{petro} flux estimates for these three major rivers, further refining global the POC budget.