

Multi-index reconstruction of terrestrial organic carbon burial history in the East China sea over the past 300 years

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Terrestrial organic carbon (OC) deposited in river-dominated continental margins plays a critical role in the global carbon budget. However, our knowledge of the burial processes and fate of terrestrial OC, influenced by both natural and anthropogenic factors, remains limited. In this study, the burial history of terrestrial OC in the East China Sea over the past 300 years was reconstructed, including relatively labile soil OC and recalcitrant fossil OC, using source-specific biomarkers in sediments. Hopanoids with geological configuration and short-chain even-numbered alkanes ($n\text{-C}_{16}$, $n\text{-C}_{18}$) served as indicators of fossil OC derived from rock weathering prior to the 1980s and later from petroleum contamination, exhibiting typical characteristics of mature OC. A good correlation between geological hopanoids and long-chain alkanes/alkanols suggested coupled biogeochemical processes of rock-associated OC and soil-derived OC, likely driven by soil erosion within the drainage basin.

The burial history of terrestrial OC can be divided into four stages over the past 300 years, transitioning from Asian monsoon dominance (pre-1800s) to anthropogenic control (post-1980s). An opposite trend in terrestrial OC deposition from the 19th to the late 20th century was observed, based on the terrestrial/aquatic ratios of alkanes and alkanols, as well as results from the binary mixing model of $\delta^{13}\text{C}$ values. Variations in hopanoid maturity indicators during these periods suggest that soil erosion in the drainage basin may have fluctuated, significantly influencing the bulk characteristics of terrestrial OC. Biomarker and bulk $\delta^{13}\text{C}$ records highlight temporal shifts in the $\delta^{13}\text{C}$ end members of terrestrial OC. This can be attributed to extreme climatic events and anthropogenic activities. Consequently, fossil OC indicated by hopanoids provides new insights into rock-associated carbon fate, advancing our understanding of terrestrial OC in the global carbon cycle.