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Widespread deposition of pre-aged terrestrial organic carbon on the tropical epicontinental sea

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Terrestrial organic carbon (OC) discharged by river systems and buried on continental shelves constitutes a major component in the global carbon cycle. However, dispersal and fate of terrestrial OC on the continental shelf have remained unclear and debated. Here, we present OC compositions of sediments from a tropical epicontinental sea, the Gulf of Thailand and the adjacent Mekong shelf, and rivers from surrounding continents. We find that stable carbon isotope composition ($\delta^{13}C$) and radiocarbon activity (F_m) of sedimentary OC on the shelf falls between those of river sediments, composed of C3 plant-dominated pre-aged soil and petrogenic OC, and of marine OC with various reactivities, indicating that sedimentary OC has been derived from these sources. Mixing model results show that fractions of terrestrial OC (both pre-aged soil and petrogenic OC) in shelf sediments account for ~31 ± 14%, with the rest comprising marine OC. Spatial variations in the sedimentation rate of terrigenous material, marine primary production, and hydrodynamic condition determine the proportions and contents of terrestrial and marine OC in sediments of these shelves. Soil OC and marine OC are subject to intensive degradation, while petrogenic OC is conservative during transport and offshore dispersal. Comparable estimated depositional amounts of marine OC and terrestrial OC dominated by pre-aged soil in this area highlight the importance of fluvially derived terrestrial OC burial on continental shelves in the context of the global carbon cycle.