Highly dynamic partitioning of iron-bound organic carbon in a large-river delta-front estuary

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Understanding the mechanisms of long-term storage of organic carbon (OC) in marine sediments are important for studying the carbon cycling in the ocean. In this study, we examined total OC (TOC), sediment surface area (SSA), grain size, reactive iron (Fe_R), Fe assocaited-OC (Fe-OC) and $\Delta^{14}C/\delta^{13}C$ signatures of Fe-OC in suspended particulate matter (SPM) and surface sediments of the Changajiang Estuary and adjacent shelf, to better understand the role of reactive iron in the preservation of sedimentary OC. The TOC, Fe_R and Fe-OC in SPM were significantly higher than those in surface sediments, and there were no significant defferences of these parameters between surface- and bottom-water SPM, which indicated that the loss of OC and reactive iron were mostly occurred at the sediment-water interface. However, the percentage of Fe-OC to TOC in SPM (6.4 ± 2.3%) and mobile-muds sediments (7.7 ± 1.9%) were comparable, which is likely because Fe-OC and TOC decreased proportionally during sediment deposition. Unusually low TOC loadings and Fe-OC/Fe ratios were found in mobile muds, suggesting that frequent physical reworking may reduce Fe_R binding with OC. The $\delta^{13}C/\Delta^{14}C$ of Fe-OC in SPM increased along the salinity gradient, indicated that Fe_R could continuously combine marine and young OC in water column during transport. However, both ^{13}C and ^{14}C of Fe-OC in deltaic regions and mobile-muds were more depleted relative to TOC (-29.8 ± 3.1‰ vs. -23.2 ± 0.6‰ and -644.4 ± 295.7‰ vs. -398.9 ± 122.6‰, respectively), indicated that young marine OC in Fe-OC is selectively decomposed during sediment deposition, resulting in the realative enrichment of terrestrial OC. Our results showed that Fe_R plays an important role in the preservation of terrestrial OC in estuarine environments.