

***Exploring clay mineralogical
influences on organic carbon
sequestration in tropical coastal
environments of East-Southeast Asia***

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The burial of organic carbon (OC) in sedimentary basins plays a fundamental role in Earth's carbon cycle by facilitating the removal of CO₂ from the atmosphere. Clay minerals are hypothesized to enhance OC burial over geologic timescales through organo-mineral interactions. However, uncertainties remain regarding their quantitative capacity to sequester OC and the factors that govern the long-term stability of this mineral-bound carbon. These knowledge gaps are especially consequential in coastal ecosystems, which are estimated to contribute approximately 50% of global marine carbon burial despite occupying less than 2% of ocean area. Here, we investigate the role of clay mineral assemblages in OC sequestration in tropical mangrove systems, where high sedimentation rates and reactive mineral fluxes may amplify carbon stabilization processes. We analyzed and compared sediment cores collected from mangrove forests in Hong Kong and Palawan (Philippines), targeting localities with catchments that are dominated by either silicic igneous and metamorphic basement or mafic to ultramafic-bearing ophiolitic bedrock to contrast potential clay mineralogical assemblages. Integrative data from sediment facies analysis, particle size distribution measurements, radiocarbon dating, X-ray diffraction, soil fractionation, loss-on-ignition tests and stable carbon and nitrogen isotope analyses enabled comprehensive reconstruction of depositional environments, establishment of stratigraphic chronology, characterization of clay mineral assemblages, differentiation between mineral associated organic matter and particulate organic matter fractions, quantification of carbon content and elucidation of the OC sources. Our new data provides constraints on the different carbon sequestration capacities of various clay mineral types and the persistence of mineral-OC complexes in coastal environments. These findings will provide a mechanistic framework to refine predictions of coastal carbon sink sustainability, particularly mangroves, and reinterpret mineral-climate feedbacks in paleoenvironmental archives.