14C Characteristics of Iron-bound Organic Carbon in Soils

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Reactive iron (Fe) is known to play an important role in organic carbon (OC) stabilization in sedimentary settings through sorption and/or co-precipitation between organic matter (OM) and reactive iron (hydro)oxides, forming chemically stable Fe-OM complexes. Such Fe-OM associations are considered to hamper microbial decomposition and are estimated to stabilize ca. 22% of OC in marine sediments. However, direct evidence on the persistence and fate of Fe-OM complexes is still lacking. Natural-abundance radiocarbon dating provides an excellent alternative to directly examine the residence time or turnover of Fe-bound OC in natural environments. In this study, we examine the 14C signature of Fe-protected OC released by citrate-bicarbonate-dithionite (CBD) method from soils and sediments in wetlands, forests, deserts, and marine systems, aiming at revealing the preservation and turnover time of Fe-bound OC. Coupled with a comprehensive list of environmental factors, we also investigate variables controlling the age of Fe-bound OC along soil depths and environmental gradients. Overall, the combination of 14C analysis and CBD treatment allows us to gain more insight into the role of Fe to protect OM in natural depositional settings.