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Spatiotemporal distribution of organic matter buried in estuarine seagrass meadows

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Blue Carbon, captured and sequestrated by marine organisms, has attracted attention as one of the major sink of atmospheric carbon dioxide. One of the important process for carbon sequestration is burial of organic carbon into sediments. The burial rate of organic carbon is higher in estuaries and seagrass meadows than open oceans. A large amount of terrestrial carbon flows into shallow coastal systems, consequently being buried in the sediment. Also nutrient inflows elevate autochthonous organic matter production in the systems. Therefore, various organic matter compositions, having different origin and bioavailability, are mixed in shallow waters. In this study, we investigate the quality and quantity of organic matter buried in an estuarine seagrass meadow using elemental and isotopic techniques and ^{14}C dating.

Our study site, the Furen Lagoon, is located at the high latitude in Japan. The Furen lagoon is eutrophic due to riverine inflows. Seagrass meadows occupy 67 % of the total area of the lagoon. We collected core samples (about 2 m) in the lagoon along the salinity gradient. TOC (total organic carbon) and TN (total nitrogen), as well as carbon and nitrogen isotopic signatures were analyzed along the depth. Also Δ ^{14}C was analyzed for dating. In the low salinity zone, δ^{13}C was low and C/N ratio was high, indicating that terrestrial organic matter was dominant. These signatures were relatively stable with sediment depth, showing that terrestrial organic matter would have been buried for thousands years. Within the seagrass meadow, δ^{13}C and δ^{15}N were relatively high, indicating that the contribution of autochthonous organic matter (phytoplankton and seagrass) to TOC would increase in the presence of vegetation. δ^{13}C fluctuated with sediment depth in the seagrass meadow, showing that the contribution of terrestrial organic matter fluctuated temporally. These results suggest that the lagoon can be the long-term sink of carbon due to autochthonous production and deposition of terrestrial organic carbon.

Keywords: carbon sequestration, blue carbon, estuary, seagrass meadows, stable isotope, 14C dating