An Investigation of the Mississippi-Atchafalaya River System as a Source or a Sink of Organic Carbon

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Ranked seventh among the world's major rivers in terms of its sediment discharge rate, the Mississippi-Atchafalaya River System (M-ARS) contributes over 40% (4.0 x 10^9 kg) of the United States' annual export of total organic carbon (OC) and dissolved inorganic carbon (DIC) from land to the marine environment. However, it is challenging to determine the M-ARS's exact role in the global carbon cycle because of the system's overall complexity. Covering 41% of the continental United States, the M-ARS's drainage basin has two main outlets into the Gulf of Mexico (GOM): the Atchafalaya River and the Bird's Foot Delta. Identifying the relative proportion of labile OC to refractory OC entrained in both the lower Mississippi and Atchafalaya Rivers as well as in their river plumes in the GOM, would help determine whether the M-ARS represents a source or a sink of OC. The M-ARS receives organic material from a variety of sources, including grasslands and farmlands in the north, coastal wetlands, and primary productivity prior to discharge in the GOM, but the biodegradation of this organic matter prior to burial and preservation in the stratigraphic record in the GOM has not been quantified. Using determinations of radiocarbon content in fractions of OC that differ in lability, we evaluate the age spectra of particulate OC transported in the lower Mississippi and Atchafalaya Rivers and their river plumes. Our method uses thermochemical stability as a proxy for lability. In this study, we present a comparison of acid insoluble particulate organic matter transported down the lower Mississippi and Atchafalaya Rivers and their plumes in the GOM, and report the relative proportion of labile OC and refractory OC transported in these sedimentary environments. Such research aims to help understand the complexities of the M-ARS and its contribution to the global carbon cycle.