Effect of iron on the preservation of organic carbon in marine sediments and its implications for carbon sequestration

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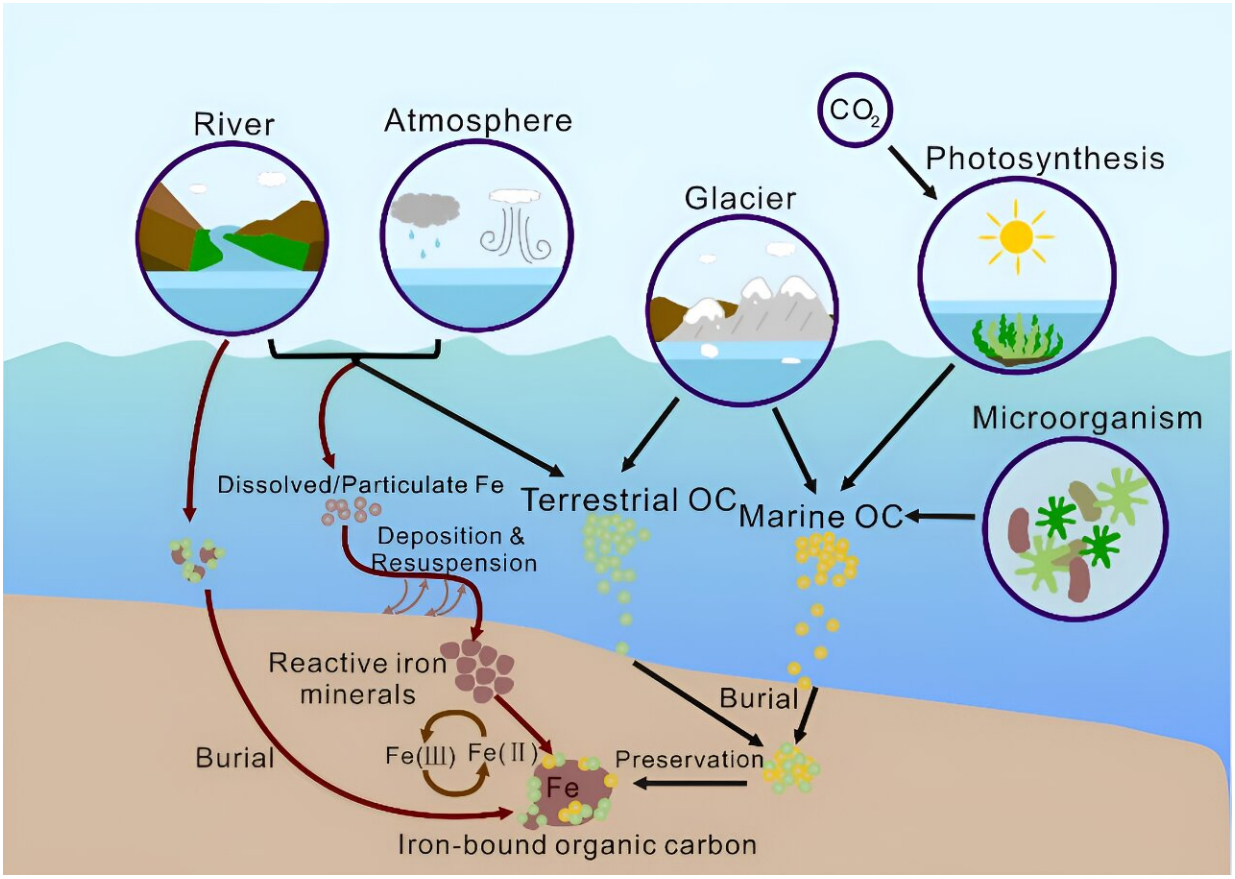
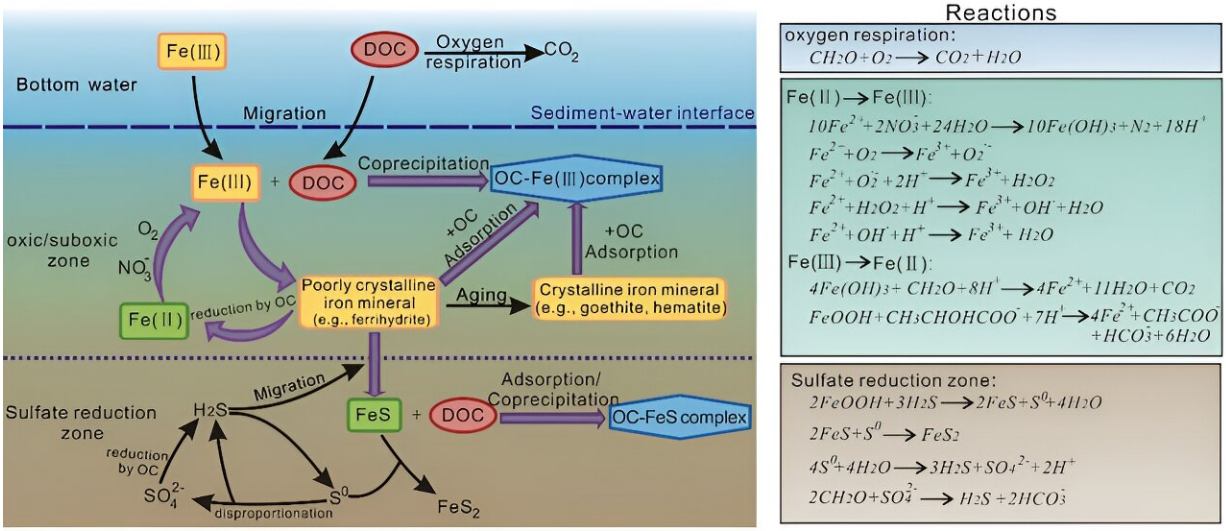


The figure illustrates the source to sink processes of iron and organic carbon (OC) and their interaction mechanism in the marine sedimentary environments, which constrained by the atmosphere, rivers, glaciers, the biological pump, and sedimentary processes. It also emphasizes the association between reactive iron minerals and organic carbon, as well as their selective preservation. Credit:

A comprehensive review article by Professor Hu Limin, Professor Yao Peng, Professor Liu Xiting, Professor Liang Yantao, Postdoctoral Fellow Zhao Bin, Postdoctoral Fellow Du Jiazong, and master candidate Ji Yuhan from Ocean University of China has been published in both Chinese and English versions of the journal *Science China Earth Sciences*.

The research team has been focusing on the long-term preservation of sedimentary organic carbon (OC) and its influencing mechanisms under different marine environments with special emphasis on the role of iron in this current study.

Marine sediments are the most significant OC reservoir in the Earth's surface system. Iron, a crucial component of the marine biogeochemical cycle, has a considerable impact on marine ecology and carbon cycling. Understanding the effect of iron on the preservation of OC in marine sediments is essential for comprehending biogeochemical processes of carbon sequestration and climate change.



The figure illustrates the dual role of iron in the redox reactions and preservation/ degradation of OC in marine sedimentary environments. It emphasizes the significant effect of early diagenetic redox zonation and the iron sulfides on the selective preservation and degradation of OC. Credit: Science China Press

This review summarizes the methods for characterizing the occurrence and structure of iron-bound OC and explores the influencing mechanism of iron on OC preservation in marine sediments from two aspects: the selective preservation of OC by reactive iron minerals (iron oxides and iron sulfides) and iron redox processes. By considering sedimentary records of iron-bound OC across diverse marine environments, the role of iron in long-term preservation of OC and its significance for carbon sequestration are illustrated.

Future research should focus on identifying effective methods for extracting reactive iron, the effect of diverse functional groups and marine sedimentary environments on the selective preservation of OC, and the mediation of microorganisms. Such work will help elucidate the influencing mechanisms of iron on the long-term burial and preservation of OC and explore its potential application in marine carbon sequestration to maximize its role in achieving carbon neutrality.

More information: Limin Hu et al, The effect of iron on the preservation of organic carbon in marine sediments and its implications for carbon sequestration, *Science China Earth Sciences* (2023). DOI: 10.1007/s11430-023-1139-9

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