Significant storage of organic carbon in mineral matrix in both land and ocean and the role of Fe

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Land-ocean linkage is one of the least understood aspects in biogeochemistry and carbon (C) cycle, which presumably results from insufficient collaboration between land and ocean scientists as well as the inherent complexity of land-to-ocean processes. At a global scale, the largest C reservoir on land is soil (1500-2400 Pg C) in which major portions of C is stored as organic C (OC) in association with soil mineral particles. In ocean, sediment holds similar amounts of OC. Thus, OC stability and reactivity in soils and sediments have been a great concern as their strong impacts on global C cycle and climate change.

In this talk, I focus on the interaction of organic C with minerals (e.g., aluminosilicate clays, hydrous iron oxides) and discuss the similarity and difference in their interaction between soil and sediment based on my own studies and the literature. I also discuss mechanistic reasons why OC is stabilized in mineral matrix in both systems. An emphasis is given to iron-C interaction due to their high reactivity and ecological importance in both terrestrial and aquatic systems. For instance, OC cycle is linked to N and P cycling as many organic compounds contain N and P. Iron can control P cycle due to strong sorption of phosphate to Fe oxides.

I plan to end my talk by emphasizing that basic understanding of soil formation and biogeochemistry would greatly help when tackling C and nutrient-related questions in river and coastal water.

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