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The unreconciled significance of terrigenous iron supply for the ocean carbon cycle

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Terrigenous sediments have long been recognised as an important external source of dissolved iron for marine phytoplankton and therefore the ocean's biological carbon pump. In recent decades, evidence from field observations and model evaluations of iron distribution and isotopic composition in the ocean has demonstrated the central importance of sediments as a contributor of dissolved iron to the ocean's margins and interior, and subsequently for primary production and carbon cycling[1]. However, an intrinsic assumption has often gone unchallenged, that 'dissolved iron' (filtered through 0.2 microns) is primarily important because of its potential to alleviate iron-limited growth of primary producers. In this talk, I will present the evidence derived from deep-ocean sediment porewater which shows the inventory of dissolved iron available to the ocean interior from weathering of terrigenous material on continental slopes, is in the form of iron colloids, or nano-scale organominerals[2], the fate and accessibility of which to phytoplankton remains unclear. I will highlight parallels between these findings and emerging evidence from elsewhere that iron nanominerals complex and preserve organic carbon in marine sediments (e.g.[3]), and advocate why it is now an exciting time to reconcile perspectives that terrigenous iron is a potential stimulus for marine carbon fixation and carbon preservation in the ocean over geological timescales and those relevant to anthropogenic climate change.

References:

[1] Tagliabue, A. *et al.* (2017) The integral role of iron in ocean biogeochemistry. *Nature* 543, 51–59.

[2] Homoky, W.B. *et al*. (2021) Iron colloids dominate sedimentary supply to the ocean interior. *PNAS* 118(13).

[3] Moore, O.W. *et al*. Long-term organic carbon preservation enhanced by iron and manganese. *Nature* (In revision)