

Recycled iron fuels nitrate consumption in all High Nutrient, Low Chlorophyll regions

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Understanding the relationship between iron and nitrate consumption in high nutrient, low chlorophyll (HNLC) regions is important because of its close association with the surface-deep transfer of carbon via the biological carbon pump. Here, using nitrate isotopes and biogeochemical modeling, I find that the external iron supply cannot explain nitrate consumption in all HNLC regions. This calls for a new conceptual model of elemental cycling in HNLC surface waters, where “recycled” iron plays the dominant role in regulating nitrate consumption. A previously unexplained connection between upwelling and nitrate consumption in iron-limited waters can now be explained as more iron recycling and nitrate consumption when upwelling is weak—a novel physical-chemical-biological relationship that may be a key factor in changing biological pump efficiency on seasonal to ice age timescales.