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Responses of microbial residents to new versus regenerated Fe in a cold-core eddy (Southern Ocean)

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Dissolved iron (DFe) supply is pivotal in setting phytoplankton productivity and bloom dynamics in remote areas. In the Southern Ocean, phytoplankton benefit from vertical Fe supply from a subsurface reservoir (termed new Fe) which triggers the beginning of the phytoplankton growth season. The main physical supplies of DFe at play are storms mixing and eddies advection. But while the relevance of physical and chemical gradients for the biological dynamics is nowadays obvious, the underlying mechanisms to restock the DFe pool and the responses of phytoplankton biomass to transient vertical of this new DFe supply remains under question. A strong hypothesis is that remineralization process in the mesopelagic zone participate to restock nutrients, including Fe.

We used a two-step experiment to simulate the seasonal DFe supply pathways on natural microbial residents acclimated to low DFe levels (late in the growth season), and to investigate their response towards a microbiologically regenerated DFe source. This study shows that regenerated DFe from subsurface particles enhances secondary production by bacteria and stimulates specific phytoplankton taxa to grow in surface waters. In particular, we present evidence that small species and non-siliceous cells were better able to take advantage of Fe regenerated from particles than large phytoplankton species. Hence, different modes of Fe/ligand supply can modify bacterial production and Fe bioavailability to phytoplankton that may drive distinctive floristic shifts and biogeochemical signatures in the Southern Ocean.