Different reactions of Southern Ocean phytoplankton size classes to iron fertilization

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ABSTRACT: During the European Iron Fertilisation Experiment (EIFEX), performed in the Southern Ocean, we investigated the reactions of different phytoplankton size classes to iron fertilization, applying measurements of size fractionated pigments, particulate organic matter, microscopy, and flow cytometry. Chlorophyll a (Chl a) concentrations at 20-m depth increased more than fivefold following fertilization through day 26, while concentrations of particulate organic carbon (POC), nitrogen (PON), and phosphorus (POP) roughly doubled through day 29. Concentrations of Chl a and particulate organic matter decreased toward the end of the experiment, indicating the demise of the iron-induced phytoplankton bloom. Despite a decrease in total diatom biomass at the end of the experiment, biogenic particulate silicate (bPSi) concentrations increased steadily due to a relative increase of heavily silicified diatoms. Although diatoms >10 μm were the main beneficiaries of iron fertilization, the growth of small diatoms (2-8 mm) was also enhanced, leading to a shift from a haptophyte- to a diatom-dominated community in this size fraction. The total biomass had lower than Redfield C : N, N : P, and C : P ratios but did not show significant trends after iron fertilization. This concealed various alterations in the elemental composition of the different size fractions. The microplankton (>20 μm) showed decreasing C : N and increasing N : P and C : P ratios, possibly caused by increased N uptake and the consumption of cellular P pools. The nanoplankton (2-20 μm) showed almost constant C : N and decreasing N : P and C : P ratios. Our results suggest that the latter is caused by a shift in composition of taxonomic groups.

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