Mass sinking of individual species populations during an iron fertilization experiment in the Southern Ocean (EIFEX)


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I. The European Iron Fertilization Experiment (EIFEX), conducted in the Polar Frontal Zone of the Southern Ocean, induced a large phytoplankton bloom in the deeply mixed surface layer (Fig. 1). In the final week of the experiment the bloom crashed as indicated by decreasing chlorophyll concentrations.

II. Chaetoceros populations crashed within days of each other at the surface (Fig. 2a) and sank out successively (Fig. 2b).

III. On day 32 of the experiment the autofluorescence signal of intact chains of Chaetoceros dichaeta faded (Fig. 3a+b), indicative of a dying population. Whereas C. atlanticus that crashed later in the experiment still showed a viable autofluorescence signal (Fig. 3c).

IV. Full, empty and broken cells and chains of e.g. Chaetoceros dichaeta sank down the deep water column (Fig. 4) and reached the sea floor at ca. 3700 m depth within 2 weeks after disappearance in the surface (Fig. 5).

V. Other species that responded later to iron addition, continued growth in the surface layer (Fig. 6). So the bloom continued after the sinking event.

Conclusions. During EIFEX the fate of an iron-induced bloom was followed in detail. For the first time the massive sinking event down the water column to the sea floor, in the aftermath of the iron-induced bloom, was examined from an ecological viewpoint at the species population level. The findings confirm similarity between oceanic and coastal blooms but raise intriguing questions concerning the evolutionary ecology of phytoplankton populations.