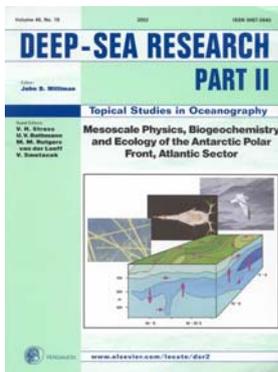


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Mesoscale Physics, Biogeochemistry and Ecology of the Antarctic Polar Front, Atlantic Sector
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The Southern Ocean is characterized by a range of unique features of which the long-standing Antarctic Paradox or high-nutrient, low-chlorophyll status has received the most attention. The low rates of primary production have been attributed to an unfavourable light climate due to deep mixing of the surface layer or to limiting concentrations of trace nutrients such as dissolved iron. Heavy grazing by protozoo- and metazooplankton is suggested to be the reason for widespread, low phytoplankton biomass. In contrast to the overall low productivity, however, high phytoplankton concentrations often have been recorded at fronts in the Antarctic Circumpolar Current, notably at the Polar Front. The reasons for the enhancement of productivity at the circumpolar fronts are, however, not yet

fully understood, though different hypotheses pertaining to the factors mentioned above have been proposed.

A series of cruises were carried out at different seasons in the Southern Ocean with *R.V. Polarstern* within the framework of the Joint Global Ocean Flux Study (JGOFS). In this Special Issue we present the results obtained from one of these cruises carried out with an aim to acquiring a better understanding of mesoscale frontal dynamics and their role in regulating productivity and biomass accumulation in austral summer. This cruise (Frontal Physics and Biology, ANT-XIII/2, 4 Dec. 1995 - 24 Jan. 1996) comprised detailed surveys of the distribution patterns of physical, chemical, and biological variables across the Antarctic Polar Front and encompassed long, approximately meridional transects and quasi-synoptic 3-D surveys carried out with an instrument package composed of a towed undulating vehicle (SeaSoar) and a vessel-mounted acoustic Doppler current profiler accompanied by surface-water sampling.

The first long transect between Cape Town and the sea-ice edge (5–11 Dec. 1995) revealed the position of the various fronts embedded within the Antarctic Circumpolar Current and their biological signatures. The transect was repeated between 22 and 24 Dec. with the ship heading northward. Information from the transects was used for selecting the sites of detailed quasi-synoptic 3-D surveys. A coarse-scale survey (CSS hereafter), consisting of 6 parallel meridional sections 75 km apart, covered the larger meander structures in an area of roughly 375 km west–east by 220 km south–north from 24 to 29 December 1995. A fine-scale survey (FSS hereafter, from 1 to 5 Jan. 1996), consisting of 11 meridional sections 13 km apart, was nested within the CSS to resolve the mesoscale details in an area of about 130 km west–east by 130 km south–north.

Measurements of chemical and biological properties from discrete depths in the water column were taken at stations at the beginning and end of each survey and also from a high-resolution transect placed through the area of the FSS after its completion. The original intention of repeating the FSS had to be abandoned for logistical reasons. The study site was visited again some 3 weeks later. Lack of ship-time allowed occupation of only a restricted number of representative stations located in the same positions as earlier stations. These last stations provided an indication of the rate of change in the intervening period.

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