Reconstitution of biogenic particle flux in the Indian sector of the Southern Ocean during the last 140 kyrs deduced from ^{230}Th profiles in sediment cores

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Ice core records show that the atmospheric concentration of carbon dioxide decreased during past glacial periods (Barnola *et al.*, 1987). Southern Ocean seems to be a key area to explain these observations. Series of papers attributed the glacial lowering of atmospheric CO_2 either to enhanced 'biological pump' or to a change in oceanic circulation (Broeker *et al.*, 1986). However, estimates of past changes in Southern Ocean productivity are still discussed. In order to answer this problem, we have chosen to study spatial and temporal variations of the biogenic particle flux in the Indian sector of the Southern Ocean deduced from ^{230}Th profiles in sediment cores.

The accumulation rates of the particle reactive radionuclides ^{230}Th and ^{231}Pa are controlled by the particle flux from the water column. The interest of these two tracers is that they present different reactivity toward particles, ^{231}Pa being less reactive than ^{230}Th (Yang *et al.*, 1986). As a result of this feature, while ^{231}Pa may be supplied to high particle flux areas via transport along isopycnals (boundary scavenging) this is not the case for ^{230}Th due to its

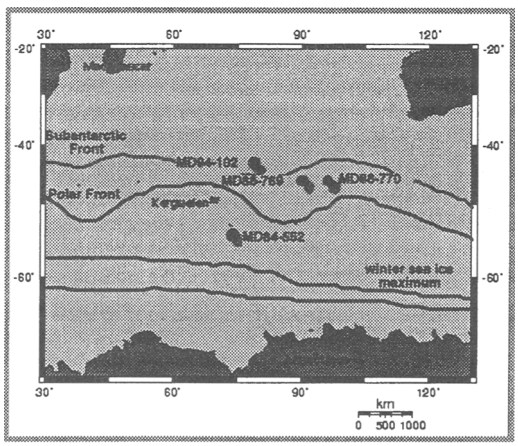

FIG. 1. Downcore locations in the southeast Indian basin of southern ocean.

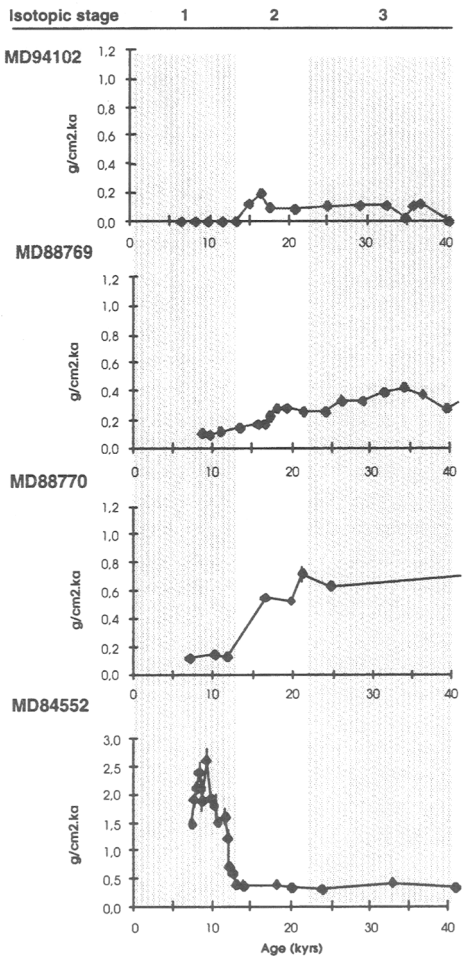

FIG. 2. Reconstitution of preserved opal flux changes in four cores during the last 40 kyrs.

independent behaviour against particle mass flux. Thus a constant accumulation rate of ^{230}Th can be assumed (equal to its production rate from soluble uranium: 2.63 dpm.cm^{-2}. kyr^{-1} per 1000 m water column) and variations of the concentration of ^{230}Th in the sediments may be interpreted as changes of the dilution with vertically settling particles. A normalization to ^{230}Th enables the calculation of vertical accumulation rates and thus a correction for focusing and winnowing effects (Bacon, 1984).

We present ^{230}Th normalised opal flux in four sediment cores crossing Subantarctic Front and Polar Front (Fig. 1). A northward shift of high productivity belt of about 5° during glacial periods can be deduced from the accumulation record. High ^{231}Pa/^{230}Th in the high productivity area confirm these results. Our results show a decrease of opal flux during glacial periods, so we can not explain the glacial lowering of atmospheric CO_2 by increase of productivity (Fig. 2).

Other productivity proxies, like organic carbon or authigenic uranium, would be also presented.

References

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