Late Quaternary diatom stratigraphy in the Indian sector of the southern oceans

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We set up Late Quaternary stratigraphies for two diatom species (*Hemidiscus karstenii* and *Eucampia antarctica*) in selected cores from the Indian sector of the southern oceans (table). As previously noted (Burckle 1983), the first abundant appearance datum (FAAD) of *H. karstenii* occurs near the oxygen isotope stages 11/12 boundary at about 430,000 years ago. The last abundant appearance datum (LAAD) occurs near the top of oxygen isotope stage 7 at about 195,000 years ago. Through this interval, abundance values for *H. karstenii* range from 0 to as high as 70 percent. Increased abundances of this species generally coincide with increased calcium cabonate concentration indicating that this species is a warm-water indicator. Our data indicate that abundance fluctuations in this species are time dependent and that a stratigraphy based upon these changes can be set up for the subantarctic region. This stratigraphy appears to be applicable for all sectors of the southern oceans north of the Polar Front. We have no evidence at present that it can be applied to regions south of the Polar Front.

Cores used in this study

Core	Latitude (south)	Longitude (east)	Depth (in meters)	Length (in meters)	Estimated age of bottom (in thousands of years)
E45-29	44°53′	106°31′	3,863	11.7	490
E49-17	48°17′	90°15′	3,542	13.0	460
E49-18	46°03′	90°10′	3,291	15.0	480
E49-25	49°23′	94°50′	3,283	5.4	250

A late Quaternary stratigraphy based upon changes in abundance of *E. antarctica* was previously set up by Burckle and Cooke (1983) for the Weddell Sea region. This, however, appears to have limited value in that it cannot be applied with confidence to other regions of the southern oceans south of the Polar Front, and there is definite evidence for diachroneity between sites north and south of the front (Burckle and Abrams in press). Within the subantarctic region of the Indian sector, however, our data show that abundance peaks and troughs of this species are correlative from site to site, at least between the interval from oxygen-isotope substage 5e and the stage 11/12 boundary (about 120,000 to 430,000 years ago). These data are not correlative with *E. antarctica* abundance changes in the subantarctic of the Pacific sector, however. Increased abundance of *E. antarctica* in the Indian sector occurs on glacial/interglacial and interglacial/glacial transitions rather than on glacial maxima. Most commonly, the maximum abundance will occur at a glacial/interglacial transition, the single exception being the oxygen isotope stage 6/7 boundary.

We applied spectral analysis on core E49-17, using a provisional age/depth model indirectly tied to oxygen isotope stages. Most of the variance is concentrated in three spectral peaks of 100,000, 42,000, and about 21,000 years. These peaks closely correspond to the dominant periods of the Earth's solar orbit and essentially agree with the work of Hays, Imbrie, and Shackleton (1976). The 100,000-year component is dominant and has an average period close to orbital eccentricity.

E. antarctica is considered to be a largely ice-related form (Burckle 1983). In the present day southern oceans, it is found in highest abundance close to the continent, adjacent to icebergs (Gombos 1976) and associated with sea ice. Its abundant presence in late Quaternary sediment of the sub-antarctic rules out sea ice as a direct causal mechanism. Recently, however, Labeyrie et al. (in press) reported a close correlation between increased *E. antarctica* abundance during the late Quaternary and decreased surface salinity. This low-salinity layer is believed to be due to increased calving and melting of icebergs during glacial and deglacial intervals. This is supported by our data for the last glacial maximum in the Weddell Sea (Burckle 1983, unpublished data).

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