Calcareous Nannofossil Fragmentation as a Dissolution Proxy: A Case Study from the Eocene-Oligocene Transition at ODP Site 1090 (Agulhas Ridge, South Atlantic Ocean)

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The Eocene-Oligocene Transition (EOT) (~34 Ma) is characterized by global cooling and Antarctic ice-sheet expansion, sea level fall, deepening of the calcite compensation depth (CCD), and significant turnover in marine and terrestrial biota. CCD deepening at the EOT is interpreted worldwide based on an increase in carbonate accumulation at multiple deep ocean sites. In the South Atlantic, the CCD is interpreted to have deepened by ~1 km, but a detailed CCD history across the EOT has not been previously developed for this region. In this study, quantitative analysis of calcareous nannofossil assemblage was carried out within the EOT interval at ODP Site 1090 (42°S; Agulhas Ridge; South Atlantic). The primary goals of this work were: (1) to assess the degree of dissolution affecting nannofossil assemblages; (2) to use the nannofossil dissolution signal as proxy for CCD variation; and (3) to characterize surface-water temperature and nutrient changes during the EOT using paleoecological information provided by nannofossils.

Within the EOT interval of ODP Site 1090, two indices of dissolution were calculated using the preservation state of two common taxa: *Coccolithus pelagicus* and *Reticulofenestra umbilicus* group. A third dissolution index was calculated using characteristics of the entire assemblage. Comparison between the nannofossil indices and carbonate content shows a striking correspondence, indicating that dissolution was a major factor controlling carbonate sedimentation and nannofossil preservation/assemblage composition in the EOT interval at this site. Additionally, there is a good correspondence between carbonate content and *Blackites* and *Clausicoccus* abundance, suggesting that dissolution is also a major factor in controlling the stratigraphic distribution of these taxa.

Variation in nannofossil dissolution indices and carbonate content through the EOT interval of Site 1090 are interpreted to reflect CCD fluctuations. The CCD at this site markedly oscillates in the latest Eocene and then deepens in the earliest Oligocene in correspondence with oxygen isotope ($\delta^{18}O$) Step 2 (coincident with Oi-1). An intense dissolution interval is observed in the latest Eocene immediately prior to oxygen isotope Step 1. Within this dissolution interval, however, only one sample is totally barren of nannofossils and the total abundance varies with carbonate content, suggesting that nannofossil assemblages are good dissolution indicators even in extreme conditions of carbonate under-saturation. Nannofossil dissolution indices also define an interval of carbonate dilution just prior to oxygen isotope Step 2, which results from an increase in biosiliceous sedimentation.

A selection of well-preserved samples was used for the paleoecological interpretation of nannofossil assemblages across the EOT at Site 1090. A major assemblage change is observed near the E/O boundary (~33.6 Ma) and is interpreted to reflect an increase in sea-surface nutrient availability, possibly in conjunction with cooling. This event is followed by a gradual increase in fertility associated with cooling which culminated at Step 2. Following Step 2, nannofossil assemblages at Site 1090 indicate nutrient-enriched cold waters during the earliest Oligocene.