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Global Deep-sea Dissolution During the Initiation Phase of the Eocene-Oligocene Transition

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In deep-sea records spanning the Eocene-Oligocene (E-O) transition, a two-stage positive shift in marine carbonate δ^{18}O values has been shown to occur in tandem with a two-step global deepening (by $\geq$1 km) of the calcite compensation depth (CCD). The oxygen isotope shift and interpreted de-acidification of the deep waters are intricately linked to major global cooling and expansion of polar ice sheets, representing the most significant step towards 'icehouse' climates of the Paleogene time interval. The initial or precursor phase of major global climate changes across the E-O transition, however, has previously received little attention. Compilation of multiple deep-sea foraminiferal stable isotope and carbonate concentration records indicates that the initiation interval (at $\sim$34.0 Ma) is characterized by both a negative carbon isotope excursion and a strong carbonate dissolution horizon at several deep-sea sites around the globe. These records indicate that global CCD changes through the E-O transition are clearly more complex than previously thought. We hypothesize that the dissolution event reflects a rapid, but brief, shoaling of the CCD due to a decrease in carbonate ion saturation (acidification) of deep waters. This shoaling episode occurs immediately prior to the beginning of global deep-sea cooling/continental ice-sheet expansion, as indicated by the first positive foraminiferal δ^{18}O shift, and the well-documented CCD deepening in the equatorial Pacific. On-going study of this "initiation phase" is aimed at determining whether reconstructed CCD histories and benthic foraminiferal δ^{13}C records at multiple sites can provide further insight into changes in marine carbon cycling and, furthermore, mechanisms of climate change across the Eocene-Oligocene transition.