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A size-specific record of diatom-bound organic carbon isotopes over the Eocene/Oligocene boundary

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Marine diatoms, ubiquitous silicifying photosynthetic algae, are major contributors to marine primary production in the modern ocean. In all primary producers, the enzyme Rubisco catalyzes the fixation of carbon from CO_2. Due to the low concentration and slow diffusion rates of CO_2 as a substrate in naturally buffered seawater, most marine algae have evolved mechanisms for concentrating CO_2 around the Rubisco enzyme. The efficiency of these carbon concentration mechanisms may be reflected in the carbon isotopes of organic matter preserved within sedimentary nannofossils, and is hypothesized to change in response to ambient CO_2 concentration.
As a first order investigation into the relationship between carbon concentration related to cell size and isotopic fractionation of carbon into organic matter, or εp, in response to changes in CO_2, we have created a novel record from IODP site 1090 in the Atlantic sector of the Southern Ocean, spanning the marked temperature and gradual pCO_2 decline across the Eocene/Oligocene boundary. Using size microseparation of diatom silica and established cleaning techniques to isolate organic material trapped inside the diatom frustules, this record provides a size fraction-specific account of εp from marine diatoms. Comparing these individual records with the bulk diatom record from this site elucidates the potential effects of size related carbon concentration on trends in εp across the E/O boundary and may reveal further insight into the magnitude of CO_2 decline.