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A coupled record of marine nitrogen and sulfur cycling in the early Eocene South Atlantic

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Across the Cenozoic, there have been large changes in ocean biogeochemistry and climate. In the early Eocene there was a major shift in the nitrogen cycle, as observed by an increase in planktonic foraminifera bound $\delta^{15}N$ (FB-$\delta^{15}N$), attributed to ocean circulation and oxygenation changes [1, 2]. Over a similar time interval, an increase in barite $\delta^{34}S$ [3, 4] and planktonic foraminifera carbonate-associated-sulfate $\delta^{34}S$ (CAS-$\delta^{34}S$, [5]) indicate a major shift in the marine sulfur cycle. Are the cycles of nitrogen and sulfur linked on long time scales, and what implications may this have for the carbon cycle and Earth's climate? Connections between the changes in these elemental cycles is currently uncertain and somewhat obscured as previous isotope measurements were obtained on samples from distinct marine sediment sites.

To investigate this question, we are producing a coupled record of FB-$\delta^{15}N$ and foraminifera CAS-$\delta^{34}S$ from the same species-specific samples of *Morozavella* and *Acarinina* over the interval from 58 Ma to 48 Ma in the South Atlantic (IODP-308). In this way, we directly connect the trends in FB-$\delta^{15}N$ and foraminifera CAS-$\delta^{34}S$. In addition, we measured the $\delta^{13}C$ and $\delta^{18}O$ of the benthic foraminifera *Nuttalides trumpyi* picked from the same sediment samples.

We present a FB-$\delta^{15}N$ record of significantly higher resolution record than previous studies of this time period, which corroborates the 8‰ decline observed in mixed species measurements [1]. We discuss preliminary foraminifera CAS-$\delta^{34}S$ results and the connections between these elemental cycles, with the goal of identifying the similarities and differences in the change of these elemental cycles over the early Cenozoic and the implications for the carbon cycle.

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