Diatom-Bound Nitrogen Isotopes as a Diagenetically Stable Proxy for Southern Ocean Nutrient Utilization and Early Pliocene Climatic Warmth

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Overall Goal: To measure the $\delta^{15}N$ values of bulk sediment and diatom bound organic matter (DBOM) in a core from the Southern Ocean spanning the late Miocene to Pliocene climate transition (~6-2 Ma) as proxies for nutrient utilization.

Hypothesis-1: Early Pliocene warmth was associated with enhanced atmospheric CO_2 levels due to decreased nitrate utilization.

***Hypothesis-2*: Differences in the $\delta^{15}N$ values between the DBOM and the bulk sediments should provide information about sediment diagenesis.**

***Results:* Hypothesis-1. During the early Pliocene interval of global warmth, $\delta^{15}N$ values are relatively high (Figure 1B) while export production (opal and organic carbon content and accumulation rates, C-F) is relatively low. We interpret these findings to indicate that the site was dominated by nitrate depleted surface water due to a southerly location of the polar frontal zone.**

Coherent and large changes in $\delta^{15}N$ and export productivity occur at ~2 Ma. The pattern of high $\delta^{15}N$ values associated with low export production and vice versa may reflect changes in nutrient utilization in response to changes in water column stratification once the polar frontal zone has moved north of the location of Site 745.

Our results provide a mechanism for enhancing early Pliocene CO_2 level via reduced uptake of CO_2 due to low productivity in the Southern Ocean. Once the PFZ has moved north, the region may have become sensitive to changes in water column stratification potentially contributing to fluctuations in CO_2.

***Results:* Hypothesis-2: DBOM $\delta^{15}N$ values obtained thus far are inconclusive. Although the general trend parallels the bulk $\delta^{15}N$ record (Figure 1B), DOBM values are lower than expected. Work is still underway to verify these measurements.**

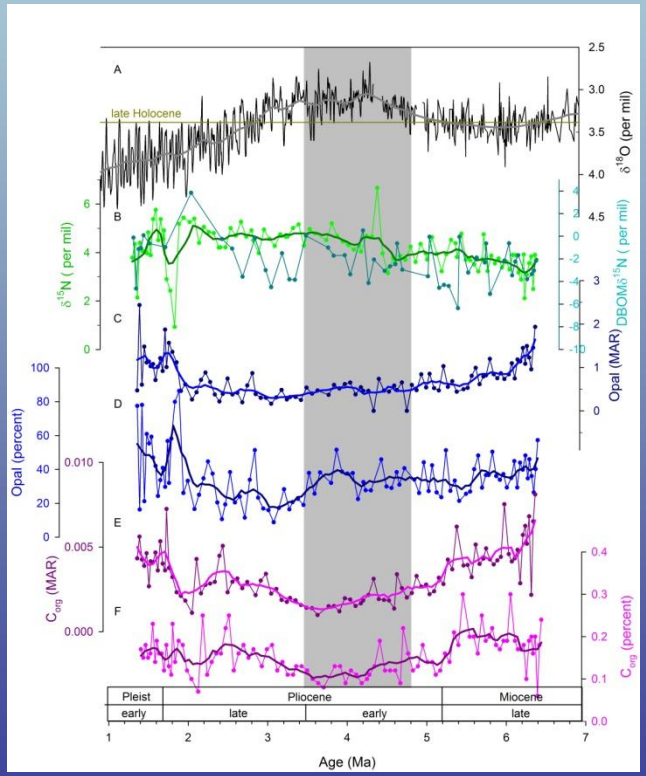

Figure 1. Down-core $\delta^{15}N$ results (B) from Site 745 compared to climate records (A) and records of export productivity (C-F, Ehrmann et al. 1991). The grey shading highlights the early Pliocene interval of relative global warmth.