Isotopic fingerprints of warm Pliocene circulation throughout the deep Atlantic

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The mid-Pliocene is the most recent interval in Earth's history to sustain global temperatures within the range of warming predicted for the 21st century. To understand this analog interval, the USGS PRISM Project has developed a reconstruction of global conditions from 3.264 to 3.025 Ma [1]. This reconstruction identifies a large North Atlantic warm SST anomaly coupled with increased evaporation; warm anomalies are also detected in the deep Atlantic ocean as far as 46°S. The PRISM interval is further characterized by a transient increase in Southern Ocean $\delta^{13}C$, which narrows the Atlantic $\delta^{13}C$ gradient [2]. This low intrabasinal $\Delta 13C$ has been attributed to either 1) delivery of northern component water to the Southern Ocean via enhanced North Atlantic overturning circulation or 2) an increase in the preformed $\delta^{13}C$ of southern coponent water due to enhanced Southern Ocean productivity.

Here, we present a new synthesis of deep Atlantic circulation during the PRISM interval, using the neodymium isotopic composition (ε_{Nd}) of fossil fish teeth as a proxy for water mass source and the $\delta^{13}C$ of benthic foraminifera as a proxy for water mass age. This reconstruction utilizes both new and previously published data [2-4] from 11 DSDP and ODP sites in the North Atlantic and along depth transects from equatorial Ceara Rise, southern mid-latitude Walvis Ridge, and south Atlantic Meteor Rise/Agulhas Ridge. Our ε_{Nd} reconstruction demonstrates that northern component water did not extend into the South Atlantic during the warm Pliocene. This conclusion has implications for the Pliocene carbon cycle and will be useful for both initialization and evaluation of future model simulations.

[1] Dowsett *et al* (2012), *Nature Climate Change* **2**, 365-371. [2] Hodell and Venz-Curtiss (2006), *Geochem. Geophys. Geosyst.* **7**, Q09001. [3] Raymo, Hodell, and Jansen (1992) *Paleoceanography*, **7** (5), 645-672. [4] Tiedemann and Franz (1997), *ODP Leg **154** Sci. Res.*, 299-318.