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Multi-proxy Sea-surface Temperature Estimates for the mid-Pliocene North Atlantic

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The USGS PRISM (Pliocene Research, Interpretation and Synoptic Mapping) Project first quantitatively documented mid-Pliocene (3.29 to 2.97Ma) warming in the North Atlantic more than a decade ago relying primarily on planktic foraminifer assemblage data for sea surface temperature (SST) estimates. Current PRISM work focuses on re-evaluating the surface ocean reconstruction of the warming utilizing a multi-proxy approach to temperature estimation. We studied magnesium/calcium (Mg/Ca) ratios in planktic foraminifers and alkenone unsaturation ratios from the middle Pliocene to estimate SST in the North Atlantic and compared these estimates with previously documented SSTs estimated from quantitative faunal analyses.

Data from DSDP and ODP Sites distributed across the North Atlantic were utilized in this study. PRISM faunal-based SSTs were estimated through multivariate statistical analyses of microfossil census data. Planktic foraminiferal species *Globigerina bulloides*, *Globigerinoides sacculifer, Globigerinoides ruber* and *Neogloboquadrina atlantica* were examined for Mg/Ca paleothermometry applying published species-specific calibrations. Alkenone-derived SST estimates were limited to DSDP and ODP cores poleward of 24˚ north latitude where alkenone paleothermometry is best suited.

Preliminary results indicate a general agreement among proxies. PRISM February and August SST estimates bracket Mg/Ca-derived annual SST estimates based on *G. bulloides* at Sites 552A and 607. Mg/Ca-derived SST estimates based on *N. atlantica* at Site 552A are cooler and closer to PRISM February estimates. PRISM SST estimates from Site 502A are warmer than Mg/Ca-derived SST estimates based on *Gs.*

sacculifer from nearby Site 999. PRISM February and August SST estimates at Site 659A bracket published alkenone-derived annual SST estimates from Site 958A. Additional results from multi-proxy SST estimate comparisons from Sites 552A and 607 as well as new results from additional sites will be presented and discussed.

Disparities in SST estimates among the proxies may result from the following considerations. First, individual species prefer different depth habitats and therefore record temperatures at different depth ranges. Secondly, Mg/Ca calibrations do not exist for each individual species, in particular extinct *N. atlantica*. Thirdly, while Mg/Ca- and alkenone-derived SST estimates are assumed to be annual temperatures, they may be seasonal, recording the temperature at the time of the bloom that may change with latitude and with time.

Preliminary comparisons of PRISM mid-Pliocene planktic foraminifer-based SST estimates with other paleotemperature proxies (Mg/Ca, alkenone unsaturation ratios) show general agreement. Calibration differences, however, should be carefully evaluated when comparing multi-proxy SST estimates.