Late Cretaceous Sea Surface Temperature Variability of the Southeast U.S.

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The Maastrichtian (66 to 72 Ma) is recognized as an analogue to future projections of a climate system with significantly elevated atmospheric pCO₂ (approximately 400 to 800 ppm [Royer et al., 2012]). Long-term trends of sea surface temperatures (SSTs) through the Late Cretaceous have suggested a global cooling from a Cenomanian (94 to 100 Ma) thermal maximum through the Cretaceous-Paleogene boundary (KPB) [Clarke and Jenkyns, 1999; Miller et al., 2005; Linnert et al., 2014]. Recent work from records of dinoflagellate and terrestrial floral assemblages, TEX86 temperature reconstructions, and benthic foraminifera δ¹⁸O values has hinted at the possibility of warm intervals, and/or oscillatory climate variability (3 to 5 °C) at timescales of less than 1 Ma in the Maastrichtian [Bowman et al., 2013; Linnert et al., 2014].

We utilized carbonate clumped isotope paleothermometry to reconstruct SSTs throughout several fossiliferous sections spanning the Late Cretaceous from the southeast US. We analyzed shell material from the Peedee (South Carolina), Ripley (Alabama), Prairie Bluff (Alabama), and Owl Creek (Tennessee) formations across the Mississippi Embayment and the modern Atlantic coastline. We found paleotemperatures ranging from 11 to 25 °C for these localities with strong reproducibility between analyzed taxa representing six genera. These results reveal temperature variations up to 7 °C throughout the Late Campanian and Maastrichtian (~76-66 Ma). There is also agreement between the Prairie Bluff and Peedee Formations, which both record the warmest temperatures just before the KPB, suggesting larger-scale regional connections between these two sites.