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Temperature and salinity evolution of marginal marine surface waters during early Paleogene hyperthermals: new PETM sections and intercomparison of temperature proxies

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Early Paleogene 'hyperthermals', including the well studied Paleocene-Eocene thermal maximum (PETM; ∼56 Ma) and Eocene Thermal Maximum 2 (ETM2; ∼54 Ma), were transient global warming phases, associated with massive injection of 13C-depleted carbon into the ocean-atmosphere system. We identified the PETM in marginal marine sediment sequences from the Southwest Pacific and the US margin of the Gulf Coastal Plain, at ∼65 °S and ∼30 ºN. We reconstruct a 6-8 °C PETM warming for these sites using the biomarker-based paleothermometer TEX86. Southern ocean temperatures were surprisingly high. Dinoflagellate cyst assemblages indicate synchronous sea level rise and salinity changes across the event. Similar to New Jersey and the North Sea records, the inception of dominant subtropical dinocysts (Apectodinium) preceded the onset of the carbon isotope excursion in the Southern Ocean. This indicates that anomalous environmental changes preceded the massive input of 13C-depleted carbon.

Finally, we compare paleotemperature estimates across the PETM based on foraminifer oxygen isotope values and Mg/Ca ratios with TEX86 at several sites. Consistency of these proxies is assessed and evaluated, at the same time putting better constraints on the 18O and Mg/Ca ratio of the seawater as well as extending the TEX86 calibration. These proxies perform relatively consistently at the studied locations, this way putting new constraints on early Paleogene seawater composition.