Dissecting the PETM along the New Jersey Coastal Plain

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The Paleocene - Eocene has become recognized as a climatically dynamic period with relatively short intervals of rapid global warming, called hyperthermals, superimposed on a warm background climate. The Paleocene-Eocene thermal maximum (PETM) is the best known and most extreme. High-resolution isotopic and biotic studies on sedimentary sequences of the New Jersey Coastal Plain provided evidence to unravel the progression of environmental changes during the onset of the PETM, but did not include evidence based on sea floor biota. In addition, the exact part of the PETM represented in the sediments at different locations is unclear because a widespread regional unconformity truncates its upper part. We present high-resolution stable isotope and benthic foraminiferal records on the expanded PETM intervals in the well-documented Wilson Lake and Bass River core sites. Correlations with other core sites (Clayton and Ancora) enable us to reconstruct the environments of deposition of this siliciclastic shelf during the Paleocene/Eocene transition.This benthic study helps to further unravel the regional biotic responses and feedback mechanisms effective during rapid global warming of shallow (neritic) marine environments.

Uppermost Paleocene foraminiferal assemblages in the glauconitic sands of the Vincentown Fm. consist of sparse, small planktic foraminifera and a diverse benthic fauna with a mixture of epifaunal and infaunal components. These sands were deposited at very low sedimentation rates in middle to outer neritic environments, under the influence of strong currents which inhibited the deposition of small particles (planktic foraminifera, clay). The onset of the PETM at the transition from glauconitic sands to silty clay (Marlboro Fm.) is marked by the abrupt carbon isotopic excursion (CIE) of 4‰, and a change to a more opportunistic, lower diverse, outer neritic assemblage dominated by *Tappanina selmensis*, *Pulsiphonina prima* and *Anomalinoides acutus*. This onset seems to be captured in the most expanded sections in the near shore areas (Clayton & Wilson Lake), where a transitional fauna is recorded, in contrast to the more off shore areas (Ancora & Bass River) where the record is very condensed as show by a very high accumulation rate of foraminiferal shells.

Stable isotope records indicate that all studied locations contain the peak interval of the PETM CIE (also called its “core”). Diversity trends indicate a steady recovery during the PETM, as reflected in the gradual decrease in abudance of opportunistic species. Overall, environmental parameters indicate that at the beginning of the PETM ocean current strength decreased abruptly, leading to elevated sedimentation rates of fine-grained material while the influx of fresh water may have increased. In addition, while water depth increased rapidly, the environment became more eutrophic and oxygen levels fell, leading to stress for the benthic biota. This implies that the continental margin regions, such as New Jersey, may have become major carbon sinks during the peak of the PETM. Regional unconformities truncate the upper parts of the PETM peak interval in the Wilson Lake and Clayton cores, so that only about 70 kyr is reflected in the sediment. Stable isotope records of Bass River and Ancora indicate the continuation of the PETM interval, including parts of the recovery phase below the regional unconformity (Bass River ~ recovery phase I & Ancora ~ recovery phases I and II). The overlying lower Eocene glauconitic sandy clays of the Manasquan Fm. contain a fauna comparable to the one of uppermost Paleocene, and indicate persistent high primary production but a return to more vigorous currents at shallower depths, although somewhat deeper than during the latest Paleocene.