**Supplementary Material to accompany**

Capturing the global signature of surface ocean acidification during the Paleocene-Eocene Thermal Maximum

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This file includes age model description, Figure S1 and Table S1-S3.

*Age Models*

The onset of the carbon isotope excursion (CIE) is identified as an abrupt decrease in carbon isotope values. Directly following the CIE onset is a depth interval with sustained negative δ13C values, termed here as the CIE core. The recovery occurs in two phases marked as successive rapid (I) and gradual (II) transitions towards positive δ13C values (Figure 2d).

At the New Jersey margin, upper Paleocene average sedimentation rates are estimated at 0.1-1.0 cm/kyr and increase to 7-8 cm/kyr [1] during the CIE due to enhanced input of siliciclastic material linked to an intensification of the hydrologic cycle [2, 3]. A range of sedimentation rates for the PETM interval are presented in the literature for New Jersey shelf sites. For the present study, precise correlation between sites, rather than exact age control, is the priority and for this reason we rely on the age constraints of Stassen et al., [1] for Bass River and Ancora, the only current effort to construct an integrated stratigraphy amongst the shelf sites. The Millville site, however, was not included by Stassen et al., [1] and we correlated bulk carbonate δ13C tie points of the CIE onset (273.96 m) and recovery (263.63 m) to Sites Ancora and Bass River to estimate sedimentation rate within the CIE core [4]. The regional unconformity within the Marlboro Formation truncates the PETM sections during the CIE recovery phase II at Bass River and Ancora sites, although the latter site is relatively more complete.

The CIE at Site 690 was first identified by Kennett and Stott [5], and the bulk carbonate δ13C record was correlated to an orbitally tuned age model [6]. Chemostratigraphic tie points previously defined on Site 690 bulk carbonate δ13C records [7] and later refined in the South Atlantic [8] were used to develop an age model for nearby Site 689 [9]. Average sedimentation rates between tie points were assumed and interpolated over the sampled depth range. Site 690 contains the entire CIE onset, body, and recovery, while Site 689 captures the onset of the CIE at higher sedimentation rate but does not contain the full CIE body or recovery due to incomplete core recovery.

**Table S1**. Site Ancora planktonic foraminifera B/Ca.

a Average sample depth interval.

b The onset of the carbon isotope excursion (CIE) is identified as the initial decrease in δ13C.

**Table S2**. Sites 689 and 690 planktonic foraminifera B/Ca.

a Average sample depth interval.

b The onset of the carbon isotope excursion (CIE) is identified as the initial decrease in δ13C.

c Sample replicates for a depth interval.

**Table S3**. Sites Bass River and Millville *Subbotina* spp. boron isotope data.

a Average sample depth interval.

b The onset of the carbon isotope excursion (CIE) is identified as the initial decrease in δ13C.

**Figure S1.** Calibration sensitivity test on boron isotope (δ11B) measurements for surface dweller *M. velascoensis* at Site 1209 [10] (a). Site 1209 δ11B record was normalized to a pre-event ocean pH of 7.75 by adjusting the intercept of the assumed δ11Bforam to δ11B calibration following a similar approach to previous studies [10, 11] (b-c). Ocean pH anomalies (ΔpH) were estimated by computing a relative δ11B change compared to an average of pre-CIE values (c). A constant seawater δ11B value of 38.9± 0.4 ‰ was assumed for the entire duration of the PETM [11]. To estimate ΔpH, we assume foraminifera incorporated δ11B with a pH sensitivity equal to aqueous boron isotope fractionation (i.e. no vital effect (δ11B= δ11Bcalcite) with a slope of 1.0). In addition, we apply modern surface dweller *T. sacculifer* slope of 0.82 [12, refit in 13]. Age is denoted in kilo-years relative to the carbon isotope excursion (CIE). Error envelopes on ocean pH estimates include the analytical uncertainty of 2 s.e. of repeat sample analyses, and conservative uncertainty estimates for temperature (± 2 °C) and salinity (± 2 units).

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