Ocean acidification during the Paleocene-Eocene Thermal Maximum at Contessa Road, Italy: Insights from weight percent carbonate content

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The Paleocene-Eocene Thermal Maximum (PETM; ~55 Ma) is defined as a period of time during which thousands of petagrams of carbon were released into the ocean-atmosphere system, causing significant global warming and ocean acidification. Biotic responses to these environmental changes included large biogeographic shifts, rapid evolution, and changes in trophic ecology, but few groups suffered major extinctions with the exception of benthic foraminifera. Guisberti et al. (2008) conducted detailed analyses of the PETM interval along the classic Contessa Road exposure within the Umbre-Marche Basin, Italy (Western Tethys). The PETM interval at Contessa Road is interpreted to have been deposited at a lower bathyal paleodepth (~1500 m), and consists predominantly of pelagic limestone with two prominent marly beds. The onset of the PETM's negative Carbon Isotope Excursion (CIE) concides with a drop in carbonate content in the lower marly bed and a second, less prominent, drop also occurs in the upper marly bed. A succession of events and changes in the taxonomic structure of benthic foraminifera has been recognized beginning at the base of the CIE, and is interpreted to be the result of the shoaling of the local carbonate saturation profile (i.e., lysocline, Carbonate Compensation Depth (CCD)) above this site. While Guisberti et al. (2008) established these basic characteristics of the PETM at this section, their sampling resolution was relatively low (~5 cm) through the two marly (low-carbonate) intervals. To refine the structure of the PETM at Contessa Road, we resampled the one-meter interval at one-centimeter resolution, and calculated wt% carbonate variations from dissolved Ca concentrations measured via Inductively Coupled Plasma – Optical Emission Spectrophotometry (ICP-OES). Our results did not reproduce Guisberti et al.'s (2008) first and major drop in wt% carbonate coincident with the CIE onset, but did reproduce the second drop in wt% carbonate within the uppermost part of the CIE. Such decreases in wt% carbonate in the upper marly bed can be interpreted to represent a transient interval of carbonate undersaturation during local shoaling of the carbonate saturation profile in response to carbon release to the ocean-atmosphere system. Resolving such local expressions of the PETM can provide valuable insights into the carbon cycle, climate, and biological responses to environmental alterations. Such local data are critical to provide a more complete global

reconstruction of the PETM, an event often invoked as an analog for ongoing anthropogenic c climate changes.