The Paleocene-Eocene Thermal Maximum in Outcrops near Bastrop, Texas: Sedimentology, Ichnology, Biostratigraphy, and $\delta^{13}C$ Isotope Values

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Abstract

The Paleocene-Eocene Thermal Maximum (PETM) is an ~200 kyr interval of global warming. Atmospheric CO_2 increased by 1200 ppm, with the PETM identified by a 3-5‰ decrease in global $\delta^{13}C$ VPDB isotope values recording a negative carbon isotope excursion (NCIE). The PETM likely impacted erosion, sediment discharge, and transport/deposition. Examining ancient deposystems across the PETM provides a unique perspective on potential effects of future anthropogenic CO_2 increases. We describe the sedimentology, ichnology, stratal stacking, biostratigraphy, and isotope record across the Sabinetown (Wilcox Group) to Carrizo (Claiborne Group) boundary in Bastrop, Texas outcrops. A total of 75+ m of outcrop was measured, photographed by drone, developed into 3D outcrop models, and sampled for bulk $\delta^{13}C$ analysis and biostratigraphy. Sabinetown deposits comprise several stacked, upward-coarsening successions. These include moderately-to heavily bioturbated flaser, wavy, and lenticular beds with interbedded, thin, laminated, fine-grained sandstones that grade upward into tabular bed-sets of parallel- laminated to modified current ripple cross laminated fine-grained sandstone. The Sabinetown is interpreted as distal delta front deposits (deltaic parasequences) including mouth bars and subaqueous channels. Carrizo deposits comprise large-scale trough crossbedded sandstone with abundant, elongate *Ophiomorpha* burrows interbedded with heavily bioturbated sandstone and heterolithic, bioturbated siltstone/sandstone. The Carrizo is interpreted as proximal delta front deposits including tidal bars. The PETM is identified as a $\delta^{13}C$ VPDB NCIE that correlates with an *Apectodinium* acme in a 'dark band' exposed intermittently below the base of the Carrizo. $\delta^{13}C$ VPDB isotope values range from -24.7‰ to -27.00‰, with the NCIE identified by values below -26.99‰. The highly complex facies, ichnology, surfaces, and stratal stacking in these outcrops provide evidence for the effect of increased atmospheric carbon and warming on coastal deposystems across the PETM. This is important not only for petroleum reservoir and aquifer modeling, but provide an analog for the coastal response to modern climate warming.