Climatic and environmental changes during the Paleocene-Eocene thermal maximum: Dababiya GSSP.

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The Paleocene Eocene thermal maximum (55.8 million years) shows an extraordinary drop in the ratio of both $\delta^{13}C_{carb}$ and $\delta^{13}C_{org}$, suggesting that a massive amount of "light" carbon was released into the atmosphere in a very short time (few hundred ky). The most likely source would have been methane from ocean sediments or continental paralic areas. The emitted CO_2 is removed from the atmosphere by silicate rock weathering reactions and organic carbon burial. This balance is thought to have stabilized greenhouse conditions. The Dababiya GSSP (Luxor, Egypt) is thought to be the most complete known PETM section. Detailed geochemical and mineralogical studies have been achieved on 125 samples spanning the PETM interval to evaluate the rate of weathering and it's feedback. The base of the Eocene is marked by a sequence boundary overlain by silty clays deposited during low sea level (Bed 1) and followed by marly shales reflecting a progressive sea-level rise (Beds 2-5). Both organic and carbonate isotopes shows a long-term decrease starting 0.5 m below the P-E boundary. The persistent shift in $\delta^{15}N$ to nearly zero reflects the gradual increased in bacterial activity. Increased Ti, K and Zr and decreased Si contents at the P/E boundary indicate high weathering index (CIA) which coincides with significant kaolinite input and suggest intense chemical weathering under humid conditions at the beginning of the PETM. Above, the presence of two negative Ce/Ce* anomalies intervals reflects anoxic conditions which prevailed during the middle PETM (Bed 2). Anoxic to euxinic conditions are also revealed by increasing U, Mo, V Fe and the presence of small size pyrite framboids (2 – 5 µm). At the same interval, productivity sensitive elements (Cu, Ni, and Cd) show maximum concentration ratios suggesting high productivity in surface water. Above, phosphorus and barium tend to precipitate as oxic conditions were re-installed (upper PETM, Bed 3). These data highlight that intense weathering is one of the crucial parameter in the chain of the PETM events, especially for the recovery phase.