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RECONSTRUCTION OF ATMOSPHERIC CARBON DIOXIDE LEVELS DURING CARBON ISOTOPE EXCURSION EVENTS

Brian A. Schubert[1] and A. Hope Jahren[2]

[1]University of Louisiana at Lafayette, School of Geosciences, Lafayette, LA 70508, USA
[2]University of Hawaii, SOEST, Honolulu, HI 96822, USA

Numerous studies have revealed globally correlated carbon isotope excursion (CIE) events recorded in marine and terrestrial substrates. These events, which are measured throughout the Phanerozoic, record large-scale changes in the global carbon cycle, yet are consistently larger in amplitude when measured in terrestrial *versus* marine substrates. Reasons for this offset have been commonly attributed to local or regional scale changes in climate or vegetation, but a mechanism that can be globally applied has been lacking. Here we show that an augmented terrestrial signal is expected due to the increased land-plant carbon isotope fractionation that results from the global rise in atmospheric carbon dioxide (pCO_2) levels associated with any massive injection of carbon into the atmosphere. We present an analysis showing how this reconciliation allows for absolute pCO_2 levels to be quantified across any global CIE, regardless of the source. When applied specifically to the highly studied, globally widespread CIE that marks the Paleocene-Eocene Thermal Maximum, we calculate background pCO_2 levels that may have been as little as 275 ppm higher than today.