Positive feedback drives carbon release from soils to atmopshere during Paleocene/Eocene warming

JENNIFER M. COTTON[1*], NATHAN D. SHELDON[2], MICHAEL T. HREN[3] AND TIMOTHY M. GALLAGHER[2]

[1]Department of Geology and Geophysics, University of Utah, Salt Lake City UT, 84112 (correspondence: jen.cotton@utah.edu)
[2]Department of Earth and Environmental Sciences, University of Michigan, Ann Arbor, MI, 48109
[3]Center for Integrative Geosciences, University of Connecticut, Storrs, CT, 06269

The Paleocene/Eocene thermal maximum (PETM) is the most rapid climatic warming event in the Cenozoic and informs us how the Earth system responds to large-scale changes to the carbon cycle. Warming was triggered by a massive release of ^{13}C depleted carbon to the atmosphere, evidenced by negative carbon isotope excursions (CIE) in nearly every carbon pool on Earth [1] [2]. Differences in these CIEs can give insight into the response of different ecosystems to perturbations in the carbon cycle [3]. Here we present records of $\delta^{13}C_{cc}$ of pedogenic carbonates and $\delta^{13}C_{org}$ from preserved soil organic matter in corresponding paleosols to understand changes to soil carbon during the PETM. CIEs during the event are larger in pedogenic carbonates than preserved organic matter for corresponding paleosols at three sites across two continents. The difference in the CIEs within soil carbon pools can be explained by increased respiration and carbon turnover rates of near-surface labile soil carbon. Increased rates of labile carbon cycling combined with decreases in the amount of preserved organic carbon in soils during the PETM suggests a decrease in the size of the soil carbon pool, resulting in a potential increase in atmospheric pCO_2 and a positive feedback with warming [4]. The PETM is a model for how the earth system responds to warming, and this mechanism would suggest that soils might serve as a large source for atmospheric CO_2 during warming events.

[1] Zachos *et al*. (2001) *Science* **292**, 686-693. [2] McInerney and Wing (2011) *Annu Rev Earth Pl Sc* **39**, 489-516. [3] Bowen *et al*. (2004) *Nature* **432**, 495–499. [4] Trumbore *et al*. (1996), *Science* **272**, 393–396.