# PP13C-1451 - A Tale of Two LIP-Induced Hyperthermals: Coupled Atmospheric and Hydrologic Changes During the end-Triassic extinction (ETE) and Toarcian OAE (T-OAE)

Monday, 9 December 2019
13:40 - 18:00

- *Moscone South - Poster Hall*

## ePoster

- Copy and pasted text document 2.txtDownload

## Swirl Topics

- Climate - SWIRL

## Abstract

Although many sources of atmospheric $CO_2$ have been identified, the major sinks are best understood in a deep-time context. Here, we focus on two Large Igneous Provinces (LIPs), the Central Atlantic Magmatic Province (CAMP) situated in the low latitude humid zone ~201.6 Ma and the Karoo-Ferrar located at high southern latitudes ~183 Ma. We use soil carbonate, lithologic, δD of *n*-alkanes, Sr data, and modeling to examine how these eruptions, hydrological cycling, and weathering impacted global atmospheric $CO_2$, carbon cycling, and biotic extinction at the ETE and T-OAE hyperthermals.
CAMP largely erupted in the tropics, doubled atmospheric $CO_2$ from ~2,500 – 5,000 ppm at the ETE (observed in soil carbonates with an onset <1000 and a duration of <~20 ky) and rapidly sequestered $CO_2$ (< 2,500 ppm) as recorded in Newark Supergroup basins (eastern US). These same strata preserve variations in the lake level expression of the climatic precession cycle based on lithology and δD. High cyclicity variance tracked high $pCO_2$ (>~4000 ppm) and drove insolation-paced increases in precipitation. Leaf wax δD shows significant variability, reflecting an enhanced hydrological cycle at the ETE with repeated sudden shifts in relative evaporation for ~1 Myr. In marine strata, $^{87}Sr/^{86}Sr$ and $^{187}Os/^{188}Os$ values track changes in $pCO_2$, suggesting a terrestrial/marine linkage through continental weathering, $CO_2$, and runoff. Despite the northward movement of these basins into the arid belt, our data suggest lower evaporation relative to precipitation driven by lower temperatures, consistent with lower $pCO_2$ due to CAMP weathering, which modeling estimates to have increased 6 to 10-fold for >1.6 Myr after the eruptive phase.
Release of $CO_2$ from the Karoo-Ferrar LIP similarly enhanced the hydrological cycle as evidenced from sedimentary observations (e.g., fine-scale turbidites and debris flow deposits) in Yorkshire (UK). The onset of the carbon isotope excursion at the T-OAE lasts 0.5 Myr with a 1.5 Myr duration modulated by astronomical pacing. Our leaf wax δD from the same strata show a transient enhancement in the hydrological cycle.
Although the Karoo-Ferrar has a limited drawdown potential when compared with CAMP-type basalts because of its higher latitude location, Toarcian weathering rates may have increased 2 to 5-fold, acting as a net sink 1–2 Myr after eruptions ceased.

## Authors

- **Jessica Hope Whiteside**
  - University of Southampton
- Joyce Ann Yager
  - University of Southern California

- Lydia Tackett
  - North Dakota State University Main Campus
- Morgan F Schaller
  - Rutgers University
- Paul E Olsen
  - Columbia University of New York


## View Related

- PP13C - Mesozoic and Early Cenozoic Greenhouse Climates: Extreme Analogues for Future Global Change II Posters
- Paleoceanography and Paleoclimatology