CAMP-induced CO_2 injection drove hydrological cycle intensification across the end-Triassic extinction

JESSICA H. WHITESIDE[1*], MARTIN PALMER[1], J. ANDREW MILTON[1], MORGAN SCHALLER[2], PAUL E. OLSEN[3]

[1] NOCS, University of Southampton, SO14 3ZH, UK (*correspondence: j.whiteside@soton.ac.uk, mrp1@soton.ac.uk, james.a.milton@noc.soton.ac.uk)

[2] RPI, Troy, NY 12180, USA (schall@rpi.edu)

[3] LDEO of Columbia University, Palisades, NY 10964, USA (polsen@ldeo.columbia.edu)

Although models predict that elevated pCO_2 intensifies the hydrological cycle, with an implied amplification of the effects of orbitally forced precipitation fluctuations, there is surprisingly little direct evidence to support a coupling during warm worlds before 0.8 Ma. One of the most pronounced Phanerozoic warm intervals (pCO_2 values >1,000 ppm) is associated with the end-Triassic extinction (~201.6 Ma), coincident with emplacement of the Central Atlantic Magmatic Province (CAMP). We used compound specific hydrogen isotopes (δD) of terrestrial higher plant derived *n*-alkanes, lithologic, and soil carbonate data to reconstruct the hydrologic cycle from Newark Supergroup rift lakes (North America) and shallow marine sections in England.

Newark Supergroup basins record variance in lake level expression of the climatic precession cycle based on lithology, and δD appears temporally linked to pCO_2 based on soil carbonate proxy data from the same strata. Cyclicity variance is high during times of high pCO_2 (~4000 ppm) including much of the Late Triassic and during the end-Triassic mass extinction when there are massive atmospheric pCO_2 injections (~5,000 – 6,000 ppm) associated with CAMP, but drops precipitously when pCO_2 declines below 2,500 ppm during the Rhaetian and early Jurassic (<2,000 ppm). This increased variance drove insolation-paced increases in precipitation. Leaf wax δD shows significant variability, reflecting an enhanced hydrological cycle at the end-Triassic extinction with repeated sudden shifts in relative evaporation. In marine strata, $^{87}Sr/^{86}Sr$ values track pCO_2 with a dramatic decrease from 0.70795 to 0.70765 suggesting a terrestrial/marine linkage through weathering, CO_2, and runoff. Even though North America was moving further north into the arid belt, sedimentary facies, δD trends and physiognomic changes in cheirolepidiaceous conifers suggest lower evaporation relative to precipitation consistent with lower pCO_2 due to CAMP weathering. δD and lithologic data from the Bristol Channel Basin support the generality of this pattern, in an area far from the CAMP eruptions.