11:00-11:30am, Saturday, March 14, 2015

Fire and Ice: The mechanism of mass extinction of continental vertebrates at the end-Triassic extinction and rise of dinosaur-dominance

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Volcanic eruptions of the giant Central Atlantic Magmatic Province (CAMP) are linked in time to the end-Triassic extinction (ETE). A striking aspect pre-ETE continental communities is geographic provinciality with diverse crocodile-line archosaurs and other non-dinosaurs in the tropics and greater higher latitude dinosaur diversity. A very few crocodile-line lineages survived the ETE, and a near-global homogenization of continental assemblages ensued.

Under Triassic high $CO_2$ there was no polar ice. The $CO_2$ doublings from CAMP produced a few degrees temperature increase and some tropical lethality, but how this led to higher cooler latitude extinctions is hard to see.

While pulses of CAMP eruptions caused $CO_2$ doublings over 10s to 100s of thousands of years, EACH major eruption produced a severe volcanic sulfur winter lasting several years plausibly leading to freezing tropical temperatures. And, there were many such coolings as opposed to a few $CO_2$ warmings.

Crocodile-line archosaurs and dinosaurs and were relatively resistant to heat induced water stress, but the former lacked insolation, while the latter had it. The lengthy super-greenhouse events allowed some crocodile-line archosaurs to escape to cooler climes, but there was nowhere to go during volcanic winters. Thus, crocodile-line and other reptile extinctions resulted from extreme cold events, for which they had no adaptations. In contrast, dinosaurs and their insulated relatives, as well as small burrowing non-dinosaurs withstood the cold spells. This scenario is consistent with global post-ETE faunal homogenization, when the higher latitude dinosaurs spread globally taking over the world.

Paraphrasing Robert Frost – ice will suffice.

17th Annual Paleofest, Burpee Museum of Natural History, Rockford, IL, March 14 & 15, 2015.