Evidence of Volcanic Sulfate Aerosols from Two Early Jurassic Eruptions of the Central Atlantic Magmatic Province (CAMP, Eastern North America)

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Two cores of this cycle in the Towaco Fm of the Newark Basin (2), show an average background $\delta^{34}S_{pyrite}$ of ~0‰ in gray, shallow-lake strata that bracket a black, highstand bed. Most of the latter is characterized by a dramatic excursion in $\delta^{34}S_{pyrite}$ to between +40‰ to +60‰ interpreted as due to closed-system microbial sulfate reduction in a progressively ^{34}S-enriched reservoir. As this lake filled and reached its outlet during its early hydrologically open phase, the basal microlaminated, fish-bearing basal layers of the highstand bed would be expected to remain ~0‰ $\delta^{34}S_{pyrite}$. Instead, $\delta^{34}S_{pyrite}$ became more depleted than anywhere else in the cycle (-20‰) suggesting an input of sulfate into the lake. This same negative excursion is also seen at two outcrops of the East Berlin Fm of the Hartford Basin. As this is the exact interval hosting the Pompton ashes at all sites, we hypothesize that this negative excursion was a consequence of direct inputs of volcanic aerosols from eruptions and subsequent drainage of airfall sulfate from the surrounding watershed that diffused into porewaters. Presumably, the airfalls immediately preceded volcanic winters.

There are 8 other similar lacustrine cycles in the Towaco and East Berlin Fms (3) that can provide independent tests of this hypothesis. We predict that most will lack a negative excursion in the deepening phases of the lakes, but will show strong positive excursions as the lakes became hydrologically closed and $\delta^{34}S_{pyrite}$ was dominated by reservoir effects. Conversely, large negative $\delta^{34}S_{pyrite}$ excursions should characterize the basal East Berlin Fm deposited during CAMP lava eruptions that have been hypothesized to produce the kind of intense volcanic winters that drove the continental expression of the end Triassic extinction (4).

(1) Olsen et al (2016) GSA Abst. Prog. 48: 10.1130/abs/2016NE-272509 (2016). (2) Stüeken et al (2019) Geochim. Cosmochim. Acta 252:240. (3) Olsen et al (2019) PNAS 116:10664. (4) Olsen et al (2022) Sci. Adv. 8:eabo6342.

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