Geophysical Research Abstracts
Vol. 14, EGU2012-13423, 2012
EGU General Assembly 2012

Perturbations to the Global Sulfur Cycle during a mid-Cretaceous Oceanic Anoxic Event (OAE 2: Cenomanian/Turonian)

J.D. Owens (1), B.C. Gill (2), H. Jenkyns (3), M.M.M Kuypers (4), S. Severmann (5), S. Bates (1), and T.W. Lyons (1)

(1) University of California-Riverside, United States (jowens@student.ucr.edu), (2) Virginia Tech, (3) University of Oxford, (4) Max Planck Institute for Marine Microbiology, (5) Rutgers University

Understanding the causes and consequences of oceanic anoxic events (OAEs) has been at the forefront of studies of paleoceanography for the last several decades. This interest stems in large part from the biological and biogeochemical impacts of these events, with possible parallels to recent expansion of coastal hypoxia and broader deoxygenation in the modern ocean. The Mesozoic Era is noted for numerous OAEs that are diagnostically expressed by widespread organic-carbon deposition and coeval positive carbon-isotope excursions. Recent work on Jurassic and Cretaceous OAEs has shown that, coupled with the overall increase in carbon-isotope values, are parallel positive sulfur-isotope excursions in carbonate-associated sulfur (CAS)—a proxy that can faithfully record the isotopic composition of seawater sulfate. The parallel positive carbon and sulfur isotope excursions of OAE 2 ($\sim$93.5 Ma) suggest the large-scale, coupled burial of organic carbon and pyrite sulfur, although the peaks of the these shifts are offset by a few hundred thousand years. The sulfate isotope curve for OAE 2 recovered to pre-event levels in $\sim$4 Ma. This observation, coupled with our preliminary modeling results, suggests that sulfate concentrations were between 5 and 7 mM compared to 28 mM present today. We have used biogeochemical box modeling to explore the factors behind the perturbations of the C–S cycles. In order to replicate the isotopic offset between the C and S data, the model demands that euxinic burial of pyrite must have continued a few hundred thousand years after the peak organic-carbon burial. Also, increasing ΔS — the difference between the isotopic composition of marine sulfate and pyrite formed from that sulfate —substantially lessens the required increase in pyrite burial needed to drive the sulfur-isotope excursion. Such a mechanism is likely, given the expansion of euxinia and the attendant increase in pyrite formation in the water column. Quantitative consideration of these cycles is of paramount importance for constraining the budgets of carbon and sulfur, but also oxygen and other elements, as we seek to improve our understanding of the mechanisms behind OAEs.