The Causes and Consequences of Cretaceous Oceanic Anoxic Events Reconsidered

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Hemipelagic to pelagic sedimentary records provide reasonable resolution and relatively low "noise" for reconstructing the nature and pacing of global episodes of enhanced organic carbon (OC) burial, termed "Oceanic Anoxic Events" (OAEs). Integrated geochemical, stable isotope, sedimentologic, and biotic records from such sediments have elucidated the causes and consequences of global organic carbon burial events, but there remain uncertainties in our understanding of the nature and magnitude of forcing of such events and their consequences.

The Aptian (OAE1a) and Cenomanian-Turonian (OAE2) events are thought to have been initiated by major volcanic episodes (construction of large igneous provinces on the seafloor). Multiproxy numerical geochemical models, with reasonable constraints on rates of oceanic basalt generation (e.g. CO2 outgassing) fit geochemical patterns exhibited in records of OAE1a, including oceanic C, Sr, and Ca isotope trends. For OAE2, however, numerical models and C isotope records indicate that volcanic CO2 production alone may not explain the measured isotope patterns in ensemble. Model simulations suggest, instead, that OAE2 may have resulted *indirectly* from plateau basalt volcanism through changes in climate and ocean overturn rates. The ca. 700 ky positive C isotope excursion characterizing OAE2 may have resulted from a sudden increase in ocean overturn rates, bringing nutrient-rich deep waters to the surface, stimulating OC production and burial, and drawing down pCO2. Post-OAE2 patterns of pCO2 increase, δ13Ccarb decrease, and weathering indicators are in accord with model results.

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