Small Changes of Paleoclimate and Paleoenvironment across the Eocene–Oligocene Transition in the Central Rocky Mountains

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Earth's climate experienced dramatic cooling during the Eocene–Oligocene Transition (EOT) based on marine oxygen isotope records. How climate and environment in continental interior responded to this cooling event are not well understood. Here we study clumped isotope temperatures and oxygen isotope compositions of carbonate cements and bulk organic carbon isotope compositions in order to reconstruct paleoclimate and plaeoenvironment across the EOT in the central Rocky Mountains, western U.S.A. The White River Formation in the eastern Wyoming is a well-dated stratigraphic unit that contains tuffaceous mudrock and sandstone deposited in fluvial and eolian depositional environments. Because the carbonate cements in the formation were formed as low-Mg calcite in equilibrium with fresh surface water during early diagenesis, the isotope compositions reflect near-surface climatic and environmental conditions. Our preliminary results of Δ_{47} vary from 0.682 ‰ to 0.713 ‰ in the Absolute Reference Frame, corresponding to carbonate crystallization temperature of 35±2 ºC to 19±3 ºC using the composite calibration for CO_2 extraction at 75-100 ºC in Defliese et al. [2015]. The temperatures do not display any obvious trend suggesting no major temperature change in the central Rockies across the EOT. The carbonate $\delta^{18}O$ values increase from ~-11.8 ‰ before the EOT to ~11.3 ‰ after the EOT, which may reflect gradual drying or a 2 ºC decrease of temperature. The organic carbon $\delta^{13}C$ values remain stable across the EOT. Our results show that the paleoclimate and paleoenvironment in the central Rocky Mountains only experienced small changes across the EOT.

Defliese, W. F., et al. (2015) Compositional and temperature effects of phosphoric acid fractionation on Δ47 analysis and implications for discrepant calibrations. Chemical Geology, volume 396, 51-60.