TRANSLATION OF ORBITAL PACING TO CLIMATE AT A TRANSITORY INTERVAL OF LOW CO2 DURING THE DAWN OF THE DINOSAURS

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The Late Triassic was a time of exceptionally high pCO_2, (~4000 ppm, paleosol proxy) (1), well known for its orbitally-paced, cyclical lacustrine rift deposits, formed during the fragmentation of Pangea (2). Here we examine the possible modulation of the expression of orbital pacing and hydrological cycles by pCO_2 in an interval of the Passaic Formation deposited from 212-213 Ma in the Newark Basin, one of the largest of these rifts that was in the tropics at the time, during an unusual transitory time of low pCO_2 ~2000 ppm) (1). Although most Newark Basin lacustrine sequences are comprised of very obvious rhythmically alternating intervals of gray and black organic rich and red strata, this interval, deposited during a transitory time low pCO_2, shows no visible cyclicity. To investigate subtle cyclicity that might reside in these strata we recovered chemical data using XRF (X-Ray Fluorescence) measured on an Itrax core scanner. We show that elemental abundances of Fe, Ca, K, S, Ti, among others, track Milankovitch cyclicity in the core. Using the TimeOpt routine in Acycle (3), the best fit for an accumulation rate is nearly identical to that derived from previous tuning to the 405 Kyr long eccentricity cycle, and the main periods in spectra of the chemical data are nearly the same and are very close to those of precession and eccentricity as well as surprisingly strong obliquity and inclination, despite the lack of visual cues. Our observations are consistent with climate models for our future [e.g., (4)] suggesting amplification of the tropical hydrological cycle under high pCO_2 (“normal” Late Triassic conditions) and by inference low precessional variability with low pCO_2, during which times obliquity and inclination may become more important climate pacers (as in our study interval).

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