
PP53A-1099: Milankovitch cyclicity in the paleotropical, fluvial, Late Triassic age strata recovered by the Colorado Plateau Coring Project (CPCP)

Friday, 15 December 2017

13:40 - 18:00

📍 *New Orleans Ernest N. Morial Convention Center - Poster Hall D-F*

Two questions addressed by the CPCP are: 1) is Milankovitch-paced climate cyclicity recorded in the fluvial Late Triassic age Chinle Formation (~227–202 Ma); and 2) do geochronological data from the Chinle support the Newark-Hartford astrochronological polarity time scale (1) (APTS). To these ends we examined the upper 157 m (stratigraphic thickness) of Petrified Forest National Park core 1A (Owl Rock, Petrified Forest, and upper Sonsela members), consisting mostly of massive red paleosols and less important fluvial sandstones.

A linear age model tied to new U-Pb zircon CA ID-TIMS dates from core 1A, consistent with published data from outcrop (2), yields a duration of about 5 Myr for this interval. Magnetic susceptibility variations, interpreted as reflecting penecontemporaneous soil and sandstone redox conditions, show a clear ~12 m cycle corresponding to a ~400 kyr cycle based on Fourier analysis in both core and hole. Similar cyclicity is apparent in spectrophotometric data, largely reflecting hematite variability. Weak, higher frequency cycles are present consistent with ~100 kyr variability. There is no interpretable ~20 kyr signal.

Such cyclicity is not an anticipated direct effect of Milankovitch insolation variations, but must reflect non-linear integration of variability that changes dramatically at the eccentricity-scale, brought about by the sedimentary and climate systems. Our results support a direct 405 kyr-level correlation between the fluvial medial Chinle and lacustrine Newark Basin section (middle Passaic Formation), consistent with new and published (3) paleomagnetic polarity stratigraphy from the Chinle, showing that the Milankovitch eccentricity cycles are recorded in lower accumulation rate fluvial systems.

Our results also independently support the continuity of the Newark Basin section and corroborate the Newark-Hartford APTS, not allowing for a multi-million year hiatus in the Passaic Formation, as has been asserted (4). We anticipate further testing our hypothesis by integrating additional results from U-Pb zircon geochronology and rock magnetic analyses of core and outcrop of the Chinle Formation.

1 Kent+ 2017 Earth Sci Rev 166:153–180; 2 Ramezani+ 2011 GSA Bull 123:2142–2159; 3 Steiner & Lucas 2000 JGR 105:25,791–25,808; 4 Tanner & Lucas 2015 Stratigraphy 12:47–65.

Authors

Paul E Olsen *

Lamont -Doherty Earth Observatory

Roland Mundil

Scientific Team: CPCP Science Party

Dennis Kent

Cornelia Rasmussen
University of Utah