CONTINUOUS, PRECESSION-SCALE RECORD OF TROPICAL ORBITAL PACING REVEALED IN THE TRIASSIC-JURASSIC NEWARK BASIN CONTINENTAL RIFT: PRELIMINARY RESULTS FROM CONTINUOUS XRF ELEMENTAL DATA OF 6700 M OF MOSTLY LACUSTRINE CORE

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New, continuous XRF elemental data from Newark Basin cores (1) reveals continuous precession-scale forcing, even from otherwise homogenous appearing red beds. Seemingly monotonous mudstone sequences occur at various thicknesses between bundles of black, grey and red transgressive-regressive lacustrine cycles demarcating patterns characteristic of climatic precession modulated by short (~100 kyr), long (405 kyr) and grand (>1000 kyr) eccentricity cycles (2). Analysis of eccentricity modulation of sedimentary facies related to lake depth (depth ranks) occurring at processional frequencies in these cores yielded testably accurate determinations of the underlying secular fundamental frequencies of perihelion of the rocky planets (2), even in the face of Solar System chaos (3). However, the long intervals without visible sedimentary facies variations or with very noisy looking variations, at eccentricity antinode lows, spanning what must be many climatic precession cycles or even multiple 405 kyr cycles, coupled with shifting relationships between accumulation rate and precessional amplitudes challenges the independent recovery of the axial precession rate. Here we use Mn/Fe (redox), Zn/Rb (detritus), K/Al (clay) variations, obtained via the Minalyzer (4) robotic continuous XRF scanner, to recover remarkably consistent cyclicity precisely matching the depth ranks facies patterns, and extending periodic cyclicity through intervals lacking consistent facies variations. This largely solves the problem of the missing information in the eccentricity lows, allowing the lacustrine expression of climatic precession cycles to be nearly continuously counted over at least 22 Myr of the early Mesozoic, thus calibrating not just the chaotic drift in planetary orbits, but also the Earth-Moon system during this impactful time in Earth History (5).

1. Olsen+ *GSA Bull* **108**:40 (1996); 2. Olsen+ *PNAS* **116**:10664 (2019); 3. Laskar, *Icarus* **196**:1 (2008); 4. Sjöqvist *Sci Drill* **19**:13 (2015); 5. Funded by NSF & the Heising-Simons Foundation.