High-resolution elemental geochemisty of the Late Triassic-Early Jurassic Newark Basin

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The Newark Basin Coring Project (NBCP) recovered the longest (~30 Myr), continusously-cored record of orbitally-paced environemental change. Collected from seven sites in the paleotropical, Triassic-Jurassic Newark rift basin, this record has been key in several different domains (e.g., tropical climate change, history of CO_2, mass extinctions, the geological time scale, solar system dynamics). Within these cores, fluctuating lake levels are recognized by changes in sedimentary facies classified as "depth ranks" and have been the principle proxy for orbitally-forced insolation variations, with secondary proxies of color, and down-hole geophyisical logs. Though depth ranks produce easily-interpreted results, the method is inherently only semi-quantitative and requires a subjective judgment of facies. Potentially objective geophysical logs have limitations leading to uncorrectable distortions in low-fequency cyclicity when the individual cores are detrended and spliced together. Difficulties in the construction of an objective geochemical proxy dataset are consequences of the depth scale (6770 m) of the NBCP, making it practically impossible to appropriately sample and quantitatively characterize its paleoenvironmentally-relevant chemistry by conventional techniques, leaving the full potential of the cores untapped. Advances in high-resolution μ-XRF core scanning have made it possible to rapidly and reliably acquire elemental data over intervals as small as 20 μm. We present major and trace element data from our proof-of-concept study, collected using high-resolution, μ-XRF core scanning (collected over 5 mm intervals and calibrated to ICP-MS), from one 400 kyr cycle of the Lockatong Fm. (Titusville core) as well as a directly correlative 100 kyr cycle (Nursery core). Preliminary results indicate Milankovitch-scale variations, consistent with prior techniques. Ultimately, we will aquire geochemical data from the full NBCP with these objectives: 1) geochemically map and explore lacustrine cyclicity; 2) document lateral variations and repeatability in chemistry between the up-dip and down-dip correlative overlap portions of the cores; 3) understand the geochemical history of the lake (redox, productivity, chemical weathering rates, etc.); and 4) construct an objective, instrumentally acquired time series of the NBCP, providing the basis for accurate tests of astronomical solutions of insolation and mapping the chaotic history of the Solar System.