Development of High-resolution Paleoclimate Dataset from Whole Rock Geochemistry of Two Continuously Cored Mesozoic Continental Sequences

Authors: Sean Kinney[1], Clara Chang[1], David M Tibbits[1], Chase R Bebo[2], Julianna Cannato[3], Chase Danyi[3], Angelina Galletta[3], Bryan Lee[3], Ryan McCracken[3], Michael Pinnella[3], Bennett B Slibeck[1], Lakshman Prabhakar[3], Ivy Stempkovski[3], Robert Witkowski[3], James V Browning[3], Kenneth Miller[3], Abhishek RoyChowdhury[2] and Paul E Olsen[1], (1)Lamont-Doherty Earth Observatory, Palisades, United States, (2)Navajo Technical University, Crownpoint, United States, (3)Rutgers University, Department of Earth and Planetary Sciences, Piscataway, United States

We present the initial data product from two projects covering a suite of Mesozoic cores in which we have produced a record of whole rock geochemistry from continuous XRF measurements using the Minalyzer CS (1).

Our data from Phase 1 of the Heising-Simons-supported Cyloastro Project span the ~6.7 km (+30-Myr) predominately lacustrine sequence recovered from the NSF-funded Newark Basin Coring Project (2). Preliminary analyses of our data indicate advances toward achieving our principal scientific goals, which include: 1) Development of continuous chemical proxies of lake depth and monsoonal climate which we can directly tie to the depositional environment and its subsequent history; 2) Recovery of the secular evolution of the fundamental frequencies of the inner planets as well as the time evolution of Earth's axial precession (k) over the length of the record; 3) Development of Triassic insolation curves from forward modeling of this data; and 4) Boundary conditions of the Earth system's sensitivity to CO2 and its modulation of orbitally paced climate cycles.

In our second, NSF-supported project, we have produced continuous whole rock geochemistry from the three cores (~ 850 m) collected during Phase 1 of the NSF- and ICDP-sponsored Colorado Plateau Coring Project (3), spanning the entire Triassic record within Petrified Forest National Park. Our principal goals include exploring whether any straightforward, process-based geochemical proxy emerges from the predominately fluvial and floodplain sediments contained within this record and to test whether the apparent lithologic cyclicity that exists in some sections reflects orbitally paced climate variability.

A societally critical product of both projects includes a library of the stratigraphic distribution of geogenic groundwater contaminants contained within these rocks, including arsenic and uranium. The geological inventory of these contaminants is poorly understood, particularly in the southwestern USA. We intend to produce a baseline understanding of the vertical/lateral distributions of these elements and develop predictive models based on paleoclimate-driven lithological variations that exist at both member and bed levels.

(1) Sjöqvist et al. (2015) Sci. Drill.; (2) Olsen et al. (1996) GSA Bull. 108:40.; (3) Olsen et al. (2018) Sci. Drill.

Kinney, S., Chang, C., Tibbits, D. M., Bebo, C. R., Cannato, J., Danyi, C., Galletta, A., Lee, B., McCracken, R., Pinnella, M., Slibeck, B. B., Prabhakar, L., Stempkovski, I., Witkowski, R., Browning, J. V., Miller, K., RoyChowdhury, A., Olsen, P. E., 2022, Development of High-resolution Paleoclimate Dataset from Whole Rock Geochemistry of Two Continuously Cored Mesozoic Continental Sequences. Abstract PP25D-0899: presented at 2022 AGU Fall Meeting, 12-16 Dec.