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The Colorado Plateau Coring Project: A Continuous Cored Non-Marine Record of Early Mesozoic Environmental and Biotic Change

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The early Mesozoic is a critical time in earth history that saw the origin of modern ecosystems set against the back-drop of mass extinction and sudden climate events in a greenhouse world. Non-marine sedimentary strata in western North America preserve a rich archive of low latitude terrestrial ecosystem and environmental change during this time. Unfortunately, frequent lateral facies changes, discontinuous outcrops, and a lack of robust geochronologic constraints make lithostratigraphic and chronostratigraphic correlation difficult, and thus prevent full integration of these paleoenvironmental and paleontologic data into a regional and global context. The Colorado Plateau Coring Project (CPCP) seeks to remedy this situation by recovering a continuous cored record of early Mesozoic sedimentary rocks from the Colorado Plateau of the western United States. CPCP Phase 1 was initiated in 2013, with NSF- and ICDP-funded drilling of Triassic units in Petrified Forest National Park, northern Arizona, U.S.A. This phase recovered a 520 m core (1A) from the northern part of the park, and a 240 m core (2B) from the southern end of the park, comprising the entire Lower-Middle Triassic Moenkopi Formation, and most of the Upper Triassic Chinle Formation.

Since the conclusion of drilling, the cores have been CT scanned at the University of Texas – Austin, and split, imaged, and scanned (e.g., XRF, gamma, and magnetic susceptibility) at the University of Minnesota LacCore facility. Subsequently, at the Rutgers University Core Repository, core 1A was comprehensively sampled for paleomagnetism, zircon geochronology, petrography, palynology, and soil carbonate stable isotopes. LA-ICPMS U-Pb zircon analyses are largely complete, and CA-TIMS U-Pb zircon, paleomagnetic, petrographic, and stable isotope analyses are on-going. Initial results reveal numerous horizons with a high proportion of Late Triassic-aged primary volcanic zircons, the age of which appears to be a close approximation of their host rock's depositional age, along with significant populations of early Paleozoic and Proterozoic zircons which will be used to identify provenance. Thermal demagnetization of paleomagnetic samples show that most Moenkopi and some fine-grained Chinle lithologies preserve a primary magnetization, and thus will allow the construction of a robust magnetostratigraphy for portions of the Triassic section. Soil carbonates are abundant throughout the cored section. All data will be integrated to construct an exportable chronostratigraphic framework that will allow us to test a number of major questions with global implications for understanding the early Mesozoic world, including: 1) do independent U-Pb ages support the accuracy of the Newark astronomically-calibrated geomagnetic polarity timescale? 2) is the mid-Late Triassic biotic turnover observable in the western US coincident with the Manicouagan bolide impact? and 3) are cyclical climate variations apparent in the cored record, and do they reflect variations in atmospheric CO_2?