The Colorado Plateau coring project (CPCP): exportable chronostratigraphic context for Triassic-Jurassic Earth System Events and Processes

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The CPCP seeks to provide a rigorous and globally exportable geochronologic framework for the rich tetrapod assemblages of early Mesozoic strata of the American West, allowing time to be assessed at problem-appropriate resolution, and events, fossil occurrences, and environmental records to be temporally linked across geography and facies. A major result of Phase 1 was the drilling of three cores during 11-12/2013 in Petrified Forest National Park, AZ, USA with the goal of obtaining a complete Triassic section where superposition is unambiguous and the section is tied to a paleomagnetic polarity stratigraphy and high-resolution U-Pb zircon dates. Core 1A (520 m), from the northern part of the park, recovered the lower Owl Rock Member (Mb) of the Chinle Formation (Fm) to the base of the formation (Late Triassic), and all of the Moenkopi Fm (nominally Early and early Middle Triassic), terminating in the Permian Coconino Fm. Core 2A (80 m) and 2B (240 m) are from the southern part of the park and recovered the lower Sonsela Mb of the Chinle through to the top of the Coconino. The 2.5 in diameter cores sample the stratigraphy at a minimum average rate of 12 m/Ma and were drilled in plastic liners, inclined from the vertical to use bedding to orient the cores azimuthally and maximize expression of the paleomagnetic reversal pattern. Redundant core orientation information was obtained by use of an in-hole core device, and additionally using CT-scans of the core (at UT-Austin NSF facility) and matching to borehole images acquired during logging. The cores have been split and scanned for physical properties (including continuous XRF elemental data) at the NSF LacCore facility in Minnesota, which will be the repository for the archive half of the cores. The working half of each core is stored at the core facility at Rutgers University and is being sampled by us for paleomagnetism, zircon geochronology, and organic micropaleontology.

The integrated Petrified Forest timescale, based on these cores, will make possible the registry of the massive amounts of surface data in the park, surrounding areas, and far distant regions to regional and global processes and events. Specific questions these cores address include : (1) Is the Newark Basin (eastern US) astronomically-calibrated “floating time scale” accurate, and does it show a faithful signal of the chaotic diffusion of the Solar System when tested by independent U-Pb dates correlated via the paleomagnetic polarity stratigraphy? (2) Was the largest identified medial Late Triassic biotic turnover synchronous with the Manicouagan impact? (3) Are the cyclical climate cycles seen in Newark lake strata discernable in the predominantly fluvial Chinle strata, and are these related to CO_2 variations? 4) Were continental biotas of tropical Pangea radically different than those from higher latitudes despite the geographic contiguity and how does the new exportable timescale inform our understanding of existing biostratigraphic correlations? Phase 1 of the CPCP is funded by NSF (SG&P/IF), and ICDP. This is a contribution to UNESCO-IUGS IGCP Project 632.