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## GSA Connects 2024 Meeting in Anaheim, California

Paper No. 207-5

Presentation Time: 3:00 PM

### ILLUMINATING EQUATORIAL ENVIRONMENTS, CLIMATE, AND LIFE OF THE PERMIAN: THE DEEP DUST DRILLING PROJECT

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Climatic, tectonic, and biotic events of the Permian are amongst the most consequential in Earth history, including Earth's sole example of icehouse collapse during a time of a well-developed biosphere. We propose to core the Permian in the subsurface of Oklahoma, where new ages confirm preservation of the *entire* Permian in sediment known to yield high-resolution data, making this a truly exceptional record of paleoenvironments, paleoclimate, and past life.

This primarily continental succession holds high-resolution archives of siliciclastics (dust) and evaporites that record the demise of the Late Paleozoic icehouse and an intensifying greenhouse culminating in Earth's most severe extinction. Persistent sediment accumulation in the long-lived sag of the Anadarko Basin produced a continuous 50 My succession of fossil Critical Zones (CZ).

We seek to reconstruct and analyze these paleo-CZs, which capture the nexus of all components of the Earth system. Fluid inclusions in bedded halite record surface water depths, pH, composition, and water and air temperatures, as well as microbes preserved for >250 My—a remarkable opportunity to study the evolution of the microbial biosphere.

Appalachian-derived detritus preserves a high resolution record of provenance critical for assessing shifts in paleoequatorial atmospheric circulation, and Appalachian exhumation. Time series analysis of data obtained from geophysical well logs and core scans will support the chronostratigraphic model while yielding information about climatic cyclicity/seasonality through the Permian.

We propose to acquire a 2000 m sediment core arrayed in unambiguous superposition, and conduct sedimentologic, paleopedologic, geochemical, geo/thermochronologic, paleobiologic, and geomicrobiologic analyses to test hypotheses focused on the interrelationships among climatic, orogenic and biotic changes through this interval characterized by pronounced Earth-system upheavals. This research addresses major questions relevant to Earth's past and its future, better constraining mechanistic linkages, e.g. among the atmosphere, climate, tectonics, and the biosphere on an Earth experiencing a cold-to-hot climate transition. Exploration of these linkages through this interval of profound change promises to expand our understanding of Earth system behavior across the Phanerozoic.

#### [Recorded Presentation](#)

Session No. 207

#### [T1. Investigating Earth's Past, Present, and Future with Continental Scientific Drilling](#)

Tuesday, 24 September 2024: 1:30 PM-5:30 PM

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