Deep Dust: Exploiting Dust and Loess Archives in Deep Time Probe Permian Continental Climate

ABSTRACT

Quaternary lake and loess deposits are amongst the highest-fidelity archives of continental paleoclimate, and form an excellent target for coring. Analogously, these sediment types should archive high-fidelity records in deep time, albeit less recognized. Here, we present a plan for continuous coring of the thickest suspected loess accumulation in Earth history, spanning the 50 My encompassing both Earth's last icehouse collapse, and largest extinction known.

The climatic, biotic, and tectonic events of the Permian are amongst the most profound in Earth history. Global orogeny leading to Pangaean assembly culminated by middle Permian time, and included multiple orogenic belts in the equatorial Central Pangaean Mountains, from the Variscan-Hercynian system (east) to the Appalachian and Ancestral Rocky Mountains (west). Earth's penultimate global icehouse peaked in the early Permian and largely collapsed soon thereafter, transitioning to full greenhouse conditions by later Permian time, thus archiving the only example of icehouse collapse on a fully vegetated Earth. The Late Paleozoic Icehouse was the longest and most intense glaciation of the Phanerozoic, with hypothesized low-elevation glaciation posited for both eastern and western tropical Pangaea during early Permian time. Reconstructions of atmospheric composition record the lowest CO_2 and highest O_2 levels of the Phanerozoic, with average CO_2 levels comparable to the Quaternary, rapidly warming climate. A global megamonsoon developed and the tropics aridified. Extreme environments are well documented in the form of voluminous dust deposits, acid-saline lakes and groundwaters, extreme continental temperatures and aridity, and major extinctions/extirpations, ultimately culminating at the Permo-Triassic boundary with the largest extinction of Earth history.

We seek to elucidate paleoclimatic conditions and forcings through the Permian at temporal scales ranging from millennial to Milankovitch and beyond by acquiring continuous core in continental lowlands known to harbor complete records dominated by loess and lacustrine strata. Our initial site is in the midcontinental U.S.— the Anadarko Basin (Oklahoma), which harbors a complete continental Permian section from western equatorial Pangaea. We will also address the nature and character of the modern and fossil microbial biosphere, Mars-analog conditions, and exhumation histories of source regions.

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Poster

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2:45pm - 3:45pm

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