# Dust as an Archive and Agent of Climate and Climate Change in Earth's Deep-Time Record

ORAL PRESENTATION

Presented by Gerilyn (Lynn) S Soreghan

Thursday, 22 August 2024

14:45 - 15:00

*Williford C (3rd floor, Hilton Chicago)*

**Subsession:** 13eO1 - Elucidating past and present changes in the atmosphere-cryosphere-ocean system through geochemical tracing

**Session:** 13e - Elucidating past and present changes in the atmosphere-cryosphere-ocean system through geochemical tracing

**Theme:** Theme 13: Climate Change: Past, Present, and Future

## Abstract

Whether it accumulates from atmospheric deposition on land (as loess), or in ice cores, caves, or marine or lacustrine settings, dust forms both an archive of climate and agent of climate change. Although dust deposits are best-known and most studied from the Quaternary, they are increasingly recognized in deep time, from the Neoproterozoic to various periods of the Phanerozoic (Ordovician, Devonian, Carboniferous, Permian, Triassic, Jurassic).

Paleoloess, or loessite— consists of quartzo-feldspathic mud-/siltstone in typically structureless (massive) units, with common paleosols and minimal signs of fluvial activity. Wet surfaces enhance dust trapping, thus monotonous sections of subaqueously deposited mudstone and siltstone can record eolian delivery where other means of transport can be reasonably eliminated, e.g., in carbonate reef-, playa- and epeiric strata.

Inferred paleoloess deposits reach thicknesses exceeding 1000 m in the Permian of paleo-equatorial Pangaea, such as the western-midcontinent U.S. and Europe, recording extraordinary volumes of dust (silt) production. Indeed, Permian loess deposits from

western equatorial Pangaea are the thickest known from any time in Earth history. Many of the approaches used to study Quaternary loess are applicable to deep-time deposits, such as particle-size analysis, provenance, rock magnetism, and geochemistry. Provenance data document derivation from the (broadly speaking) Central Pangean Mountains, after inferred transport in fluvial systems draining these mountains. Paleoloess of this and many— but not all— deep-time systems coincide with icehouse climates (e.g. Neoproterozoic, late Ordovician, late Devonian, Carboniferous, Permian).

Major loess deposits of the Quaternary commonly occur in mid- to high-latitude regions, owing to the well-known capacity for glaciers to produce silt. However, thin loess deposits also occur in warm deserts, unassociated with a glacial origin. The equatorial setting of the vast Permian loess deposits is remarkably unusual relative to the Quaternary. Regardless of origin, the voluminous dust of this time reveals elevated values of highly reactive iron hypothesized to have stimulated primary productivity.

A proposed drilling project (Deep Dust) to core the Permian of Oklahoma promises insight to the most highly resolved record of the continental Permian yet attempted, using loess and dust.

## Presenting Author

S

**Gerilyn (Lynn) S Soreghan**

University of Oklahoma