

Ancient Paintings Reveal a 6,000-Year-Old Spiritual Worldview in the Americas

Radiocarbon dating of Pecos River style murals in Texas uncovers an enduring artistic and spiritual tradition

A team of archaeologists and chemists have used cutting-edge radiocarbon dating techniques to establish that ancient murals in Texas were created continuously for more than 4000 years, beginning nearly 6000 years ago. These paintings are part of the Pecos River style pictograph tradition, which is known for its elaborate multi-colored panels set against a dramatic backdrop of limestone canyon walls. The findings demonstrate that long before the adoption of agriculture or the rise of cities and states, early inhabitants of Texas were communicating a complex worldview through a remarkably stable visual symbol system. Pecos River style murals are the earliest known surviving painted expression of a deeply rooted set of beliefs and visual conventions shared throughout Indigenous America.

Chemist Karen Steelman, Science Director at the Shumla Archaeological Research & Education Center, used a technique called plasma oxidation to extract organic carbon from paint samples for radiocarbon dating. With this method, she and her team produced 57 direct radiocarbon dates from 12 mural sites across the Lower Pecos Canyonlands. They also analyzed oxalate accretions above and below the paintings, yielding 25 indirect minimum and maximum ages. Together, these results constitute the most extensive rock art dating effort ever carried out in the Western Hemisphere.

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“Pecos River style paintings are the most securely dated rock art province in the Americas. We used two independent radiocarbon methods to date two different materials, and we got consistent results. The underlying oxalate minerals are older and the overlying mineral accretions are younger than the paint layers. This gives us confidence in the age of the paintings.” – Karen Steelman, PhD, Shumla Archaeological Research & Education Center

Using plasma oxidation and accelerator mass spectrometry, researchers determined that Pecos River style painting began between 5760 and 5385 years ago and continued until roughly 1370 to 1035 years ago. Painting spanned a duration of over 4000 years.

A Persistent Visual Language Across Millennia

The Pecos River style murals are massive multi-colored compositions painted within limestone rock shelters. The paintings depict humanlike, animal-like, and geometric figures arranged in deliberate compositions, some spanning 100 feet long and 20 feet tall. Archaeologist/artist Carolyn Boyd (PhD), a co-author on the study and professor of anthropology at Texas State University, led the effort to understand how the murals were painted. Using digital microscopy, they found that muralists consistently followed the same color application sequence. Black paint was applied first

and left to dry, then the red paint layer was added, then yellow, and finally white. These results revealed a rule-bound painting process passed down from one generation to the next across 175 generations. This confirmed that the studied murals were created as well-planned and unified compositions, rather than as a random collection of images added over time.

As the environment shifted over millennia, other aspects of the archaeological record such as stone tool technology, fiber crafts, and other technologies changed. However, the images and symbols painted throughout the 4,000-year period of pictograph production remained remarkably consistent with the continuation of specific imagery and the patterned process that guided how Pecos River style was painted.



“Forager societies in the Lower Pecos Canyonlands were creating complex paintings with a standardized visual vocabulary for over 4,000 years. The longevity and consistency of these murals indicate an enduring worldview that was shared by later Mesoamerican civilizations and is alive today within Native American communities across the continent.” – Carolyn Boyd, PhD, Texas State University

A Cultural Landscape

The Lower Pecos Canyonlands is a rugged limestone region incised by deep gorges at the crossroads of desert and plains ecosystems. Three rivers – the Pecos, Devils, and Rio Grande – join at the heart of this region in southern Val Verde County along the border of Texas and Mexico. For at least 12,000 years, the Lower Pecos served as a cultural landscape for nomadic people living primarily by hunting, fishing and the gathering of wild plant foods. Although the material culture of this foraging society can appear technologically simple, the complexity and symbolic richness of their rock art reveal a sophisticated intellectual and spiritual world. The majestic Pecos River murals show that technological simplicity does not equate to cultural or cosmological simplicity.



“With these new dates archaeologists can now refine the timing between the art and the rest of the archaeological and paleoenvironmental record. Placing this symbol system in time and tying it to the broader archaeological context brings the material and immaterial aspects of humanity together.” – Phil Dering, PhD, Texas State University

Echoes of a Pan-American Cosmvision

The continuous production of the murals in this unique landscape suggests that the canyons, caves, and rivers were regarded as places of supernatural power and ancestral emergence, linking people, landscape, and the spirit world. Comparative analysis indicates that the worldview encoded in Pecos River style murals—creation, transformation, emergence, cyclical time, and complementary

dualism—parallel concepts found in later Mesoamerican belief systems, such as the Aztec and Huichol traditions. Boyd proposes that the Pecos River murals represent one of the earliest visual expressions of what scholars have described as a “pan-New World metaphysics,” a shared set of religious and philosophical ideas that predate agriculture in the Americas.

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“These paintings may be the oldest surviving visual record of the same core cosmology that later shaped Mesoamerican civilizations and is manifested today throughout Indigenous America. They show that complex religious and philosophical thought arose among foragers long before the rise of cities and states.” – Carolyn Boyd, PhD, Texas State University

A New Era for Rock Art Chronology

By combining radiocarbon dating of organic paint ingredients with the analysis of oxalate mineral accretions, the team has established a robust chronological framework for one of the world’s most significant rock art traditions. Their approach overcomes long-standing challenges in dating mineral-based paints, opening new avenues for understanding the deep history of symbolic behavior.

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“Rock art has often been excluded from archaeological timelines because of dating difficulties. Our methods now allow us to anchor this extraordinary artistic and intellectual achievement in human history.” –Karen Steelman, PhD, Shumla Archaeological Research & Education Center

Key Findings

- 57 direct radiocarbon dates and 25 oxalate mineral dates across 12 sites in southwest Texas.
- Pecos River style painting began 5760–5385 years ago and continued until 1370–1035 years ago, lasting over 4,000 years.
- Stratigraphic and iconographic analyses show that murals were created as unified compositions following strict color and image conventions.
- Evidence suggests cultural and ideological continuity across major environmental and technological changes.
- The murals may represent the earliest surviving visual example of a shared metaphysics later seen in Mesoamerican civilizations and continuing into the present.

About the Study

The research was conducted by **Shumla Archaeological Research & Education Center** and the Department of Anthropology at **Texas State University** with partial support from the National Science Foundation and the National Endowment for the Humanities. Shumla is a non-profit dedicated to preserving the rock art of the Lower Pecos Canyonlands (shumla.org). Lead researchers and authors are **Karen L. Steelman**, **Carolyn E. Boyd**, and **J. Phil Dering**. The full study, “*Mapping the chronology of an ancient cosmovision: 4000 years of continuity in Pecos River style mural painting and symbolism*,” appears in **Science Advances**.

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More information, including a copy of the paper, can be found online at the *Science Advances* press package at <https://www.eurekalert.org/press/vancepak/>. For reporters having difficulties accessing the paper from the press package, please contact vancepak@aaas.org. After embargo lift, anyone may view a copy of the manuscript at <https://www.science.org/journal/sciadv>.

How to Visit the Painted Rock Shelters

- Seminole State Park & Historic Site in Comstock, Texas
<https://tpwd.texas.gov/state-parks/seminole-canyon>
- Witte Museum Rock Art Tours
<https://www.witemuseum.org/white-shaman-preserve/>

How to Support this Research

- Donate at www.shumla.org/donate/