Taking the guesswork out of dating - new archeological dating technique

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Advances in plasma chemistry have helped researchers ascertain the age of these cave paintings found near the Pecos River in southwest Texas.

Vibrantly colored figures silently march across a cave wall in southwest Texas. Nearby, another wall undulates with monochrome, abstract, geometric forms--wavering lines, circles, crisscrosses--repeating hypnotically.

The drawings stretch from floor to ceiling in the limestone caves and overhangs of the lower Pecos River region. Occupied from roughly 5,000 B.C. until the Spanish invasion in the sixteenth century, these ancient galleries house some of the oldest and most impressive rock art in the New World.

Anthropologists attribute the Texas cave art to Native American hunter-gatherers of Asiatic descent, but they don't know when the long-vanished tribes created the paintings. Until recently, there existed no reliable means of dating the pictographs; standard carbon-dating techniques cannot distinguish between the carbon in the paint and the carbon in the limestone "canvas."

Consequently, anthropologists have been forced to rely on the pictographs' content and style to "guesstimate" their age. Alas, this approach leaves much room for error. "At best," says anthropologist Harry Shafer of Texas A&M University in College Station, "we could say that a pictograph was painted within a time frame of some 2,000 to 3,000 years."

To overcome this limitation, Shafer sought the assistance of colleague Marvin Rowe, a chemistry professor with expertise in dating meteorites and other cosmological objects. Rowe found the cave-painting dilemma both intriguing and challenging. "I'm accustomed to measuring the age of artifacts in billions of years, not thousand of years," he explains. But he and chemists Marian Hyman and Jon Russ appear to have come up with a winning solution. Their technique can date pictographs made from paints containing a wide range of organic "binders"--blood, urine, honey, and many other natural substances used by primitive people to bind together pigments.

The new dating technique exploits advances in plasma chemistry to separate the paint's organic components from inorganic contaminants that distort the age reading. For testing, Rowe's team gathers paint chips that have flaked off the walls and scrapes paint off them, but "unfortunately," Rowe says, "we get a lot more rock than paint." To isolate the organic source of carbon, the scientists treat the specimen with an oxygen plasma. It combines only with the organic carbon in the paint because the carbon in the limestone rock is already in a fully oxidized, stable state. The reaction of the plasma and the organic carbon produces gaseous carbon dioxide, which is collected as dry ice and dated by well-established accelerator-mass-spectrometry methods that compare the number of radioactive carbon isotopes and stable carbon isotopes in the sample.

In the first trial, the technique found the painted fragment to be 3,865 years old (plus or minus 100 years), a date that jibed perfectly with an independent archaeological estimate that suggested the pictograph was between 4,100 and 3,200 years old.

Since that first trial, the researchers have tested several more pictographs from the lower Pecos as well as still-older pigments from caves in Brazil. Once again, the results were compatible with archaeologists' expectations.

If the new approach continues to prove accurate, Shafer hopes to gain fresh insights into the role that pictographs played in these long-vanished cultures. "Perhaps the symbols in the pictographs were used to communicate with supernatural forces," he speculates. "If so, maybe we'll find a correlation between creative outbursts and times of famine, overpopulation, and other

upheavals in the culture."