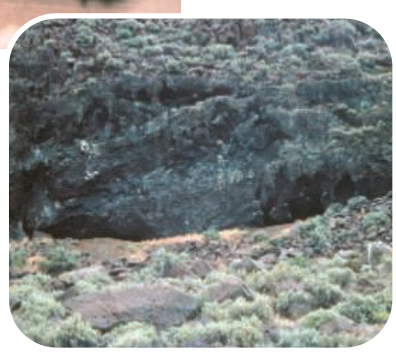
ARCHAEOLOGY

DNA From Fossil Feces Breaks Clovis Barrier

Who were the first Americans? A decade ago, most archaeologists bestowed this distinction upon the so-called Clovis people, who left elegantly fluted projectile blades across the United States and Central America beginning about 13,000 years ago. But since the late 1990s, evidence for an earlier peopling of the Americas has steadily accumulated.

Now, in a *Science* paper published online (www.sciencemag.org/cgi/content/abstract/1154116) this week, an international team reports what some experts consider the strongest evidence yet against the "Clovis First" position: 14,000-year-old ancient DNA from fossilized human excrement (coprolites), found in caves in south-central Oregon. "This is the smoking gun" for an earlier colonization of the Americas, says molecular anthropologist Ripan Malhi of the University of Illinois, Urbana-Champaign. The new work, combined with recent finds at even earlier sites in Florida, Wisconsin, and elsewhere (*Science*, 14 March, p. 1497), "add up to a human presence on the continent by 15,000 years ago," says geoarchaeologist Michael Waters of Texas A&M University in College Station. (All dates are given in calibrated calendar years.)



Prehistoric poop. Coprolites from Oregon's Paisley Caves (*inset*) push back dates for the first Americans.

But some members of both camps caution that the team has not entirely ruled out the possibility of modern contamination—or that the feces were left by dogs rather than people. There is "an element of doubt," says anthropologist Thomas Dillehay of Vanderbilt University in Nashville, Tennessee, whose excavations at a 14,600-year-old Chilean site also challenge the Clovis First paradigm.

The 14 coprolites were found in 2002 and 2003 during excavations in Oregon's Paisley Caves, led by archaeologist Dennis Jenkins of the University of Oregon, Eugene. From the size, shape, and color of the coprolites, Jenkins's team concluded that they had been produced by humans. The researchers then joined up with ancient DNA specialists Eske Willerslev and Thomas Gilbert of the University of Copenhagen in Denmark (*Science*, 6 July 2007, p. 36). The pair succeeded in extracting human mitochondrial DNA (mtDNA) with genetic signatures typical of Native Americans—and not shared by any other population groups—from six of the coprolites.

Because the coprolites were not excavated under sterile conditions, the team was not surprised to find modern mtDNA contamination from people of European origin. To ensure that the Native American DNA was not from similar contamination, researchers analyzed the mtDNA of all 55 people present at the dig, plus all 12 scientists at the Copenhagen lab. None had the Native American signatures. Next, the team called in two other well-known ancient DNA labs, which each independently verified the findings. Finally, two leading labs radiocarbon-dated the coprolites and found that at least three were 14,000 years or older.

"This is an excellent paper that will set the agenda for future research," says ancient DNA researcher Terry Brown of the University of Manchester, U.K. "I am convinced that the [human] DNA they detected is not modern contamination." Adds anthropologist David Smith of the University of California, Davis: "If this doesn't convince what's left of the Clovis First people, it should."

However, Brown, along with leading pre-Clovis skeptics such as Stuart Fiedel of the Louis Berger Group in Washington, D.C., says that the coprolites do not make an airtight case for pre-Clovis occupation. That's because the team also reported finding canid DNA in three coprolites. The co-authors suggest that humans might have eaten canids—dogs, coyotes, or wolves—or canids may have urinated on the human feces. But if these were actually canid rather than human coprolites, some researchers say, it might be the other way around: The DNA could be from the urine of humans who ventured into the caves long after the coprolites were deposited. "The coprolites are the same size and shape as both human and canid feces, and less than half of the [14] coprolites had human DNA in them," notes anthropologist Gary Haynes of the University of Nevada, Reno.

Team members reject this explanation and offer yet more data as evidence: They tested for and found human proteins in three coprolites, including two dated to about 14,000 years ago. "This nongenetic test requires more human protein than can be expected from urination," explains Willerslev. Jenkins adds that human hair was found in the coprolites too. "Whether the coprolites are human or canine is irrelevant, since for a canine to swallow human hair people had to be present in that environment," he says. "People eat canines, canines eat people, and canines eat human feces. Any way you cut the poop, people and dogs would have to be at the site within days of each other 14,000 years ago."

Such an early date nixes any claims of Clovis priority, because demographic studies have shown that early colonizers could have fanned out across the United States in as little as 100 years. "The Clovis First argument is pretty much dead in the water," says archaeologist Jon Erlandson of the University of Oregon, Eugene. "But our knowledge of what came before is still very sparse."

Erlandson, Waters, and others say the coprolite data bolster the idea that when the first Americans came east from Asia, they arrived on the Pacific Coast rather than taking an inland route. At 14,000 years ago, ice sheets would have mostly blocked the inland path. The coastal theory is attractive to many, but archaeological details have been scarce. Says Jenkins: "We may not know much about the first Americans, but if we are going to search for [them], we need to be working beyond the 13,000-year Clovis barrier."

–MICHAEL BALTER

CREDITS: DENNIS L. JENKINS

Published by AAAS