Mammoth Hunters - Out With a Whimper or a Bang?

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Skeletal remains of mammoth, horse, camel, Dire wolf, and others tell of the megafauna that roamed southern Arizona during the Pleistocene Epoch until these large animals became extinct 13,000 years ago. The time of extinction coincides with the deposition of a black algal mat, visible as a black line just above the mammoth tooth in this photo, of Younger Dryas age, when hunter-gatherers of the Clovis culture inhabited the area. No remains of Pleistocene mammals have ever been found in sediments deposited above, and thus younger than, the black layer. UA scientists unearthed the fossil pictured here southeast of the Murray Springs Clovis site, where they sampled the black algal layer to test the hypothesis of cosmic impact as the cause of extinction and Younger Dryas cooling. (Credit: C. Vance Haynes, Jr., courtesy of the Center for the Study of the First Americans)

(PhysOrg.com) -- Did a change in climate or an extraterrestrial impact bring an end to the beasts and people that roamed the Southwest shortly after the last ice age?

A team of researchers from the University of Arizona has revisited evidence pointing to a cataclysmic event thought by many scientists to have wiped out the North American megafauna - such as mammoths, saber tooth cats, giant ground sloths and Dire wolves - along with the Clovis hunter-gatherer culture some 13,000 years ago. The team obtained their findings following an unusual, multidisciplinary approach and published them in the *Proceedings of the National Academy of Science (PNAS)*.

"The idea of an extraterrestrial impact driving the Pleistocene extinction event has recently caused a stir in the scientific community," said C. Vance Haynes, a professor emeritus at UA's School of Anthropology and the department of geosciences, who is the study's lead author. "We systematically revisited the evidence for an impact scenario and discovered it just does not hold up."

Haynes has dedicated his scientific career to the study of the Clovis people - the first well-defined culture in the New World - and discovered many sites with evidence of their presence in Arizona. One of the most prominent and most studied of those sites is the Murray Springs Clovis site in southeastern Arizona, where archaeologists and anthropologists have unearthed hundreds of artifacts such as arrowheads, spear points and stone tools. The site includes the remains of a Clovis hunters' camp close to a mammoth and a bison kill site, allowing the researchers to reconstruct the daily life of the Clovis culture to a certain extent.

When the last ice age came to an end approximately 13,000 years ago and the glaciers covering a large portion of the North American continent began melting and retreating toward the north, a sudden

cooling period known as the "Big Freeze" or, more scientifically, the Younger Dryas, reversed the warming process and caused glaciers to expand again. Even though this cooling period lasted only for 1,300 years, a blink of an eye in geologic timeframes, it witnessed the disappearance of an entire fauna of large mammals.

The big question, according to Haynes, is ‘Why did those animals go extinct in a very short geological timeframe?'"

"When you go out and look at the sediments deposited during that time, you see this black layer we call the Black Mat. It contains the fossilized remains of a massive algae bloom, indicating a short period of water table rise and cool climate that kept the moisture in the soil. Below the Black Mat, you find all kinds of fossils from mammoths, bison, mastodons, Dire wolves and so forth, but when you look right above it - nothing."

Scientists have suggested several scenarios to account for the rapid Pleistocene extinction event. Some ascribe it to the rapid shift toward a cooler and dryer during the "Big Freeze," causing widespread droughts.

Haynes disagrees. "We find evidence of big changes in climate throughout the geologic record that were not associated with widespread extinctions."

Others have blamed the demise of the North American megafauna on pathogens brought onto the North American continent by animals from the Old World crossing the Bering Strait. "The disease hypothesis does not hold up well in the light of natural selection and evolution," Haynes said, "because some individuals would have been immune to the pathogens and survived."

The two attempts to account for the mass extinction event prevailing at

this point include humans and celestial bodies. Many deem it possible that humans such as the Clovis culture hunted the Pleistocene mammals to extinction, as proposed by UA Professor Emeritus Paul S. Martin.

Alternatively, it is thought that a comet or asteroid slammed into the glaciers covering the Great Lakes area, unleashing firestorms that consumed large portions of vegetation. In addition, the dust and molten rock kicked up high into the atmosphere during the impact could have shrouded the Earth in a nuclear winter-like blanket of airborne dust, blocking sunlight and causing temperatures to plummet.

In the present study, Haynes and his coworkers set out to put the evidence for an impact scenario to the test: Unusually high concentrations of spherical magnetic particles in the soil samples taken at the Murray Springs Clovis site had been interpreted as indication of an extraterrestrial source.

Another hint in this direction was a spike in the Black Mat's iridium content - an element rarely encountered on Earth but quite abundant in meteorites. In addition, the occurrence of nanodiamonds had been suggested as evidence of an extraterrestrial origin. Finally, a supposedly abundant charcoal content in the soil samples had been cited as evidence of widespread wildfires ravaging the land in the aftermath of the impact.

To ensure their samples were comparable, Haynes collected at the same locations in the Black Mat layer as the team proposing the impact scenario: "I sampled where they sampled and at the same times they sampled."

Using highly sensitive and sophisticated analytical methods, Haynes' coworkers at the department of geosciences and UA's Lunar and Planetary Lab then analyzed their samples for the evidence that had been presented in support of the impact scenario.

The team did find abundant magnetic spherules. But where did they come from? Was a meteorite the only possible source?

"Researchers have only begun to study those magnetic spherules recently, so we still don't know much about them," Haynes said. "What we do know is that they occur in exhaust from vehicles and power plants."

To determine whether the magnetic spherules found at Murray Springs could be of terrestrial origin, Haynes followed a tip from UA Geosciences Professor Anthony Jull, who suggested taking a sample of dirt from the rooftop of his house and examining it under the microscope.

Haynes remembers looking at the soil samples on a microscope slide, and "sure enough, there they were - among all the dust and grains and grit, they appeared like tiny, shiny ball bearings."

"We did confirm the other authors' findings that the magnetic spherules are concentrated in the samples at the Clovis site, but when you study the topography on which the sediments were laid down, you immediately see why: Rainwater washed them down into a river bed, where they accumulated over time. Since this is where the samples with the increased spherule content came from, we were not surprised to find more of the spherules there. The samples we took from the slopes do not have higher than normal concentrations of spherules."

What about the charcoal indicating vegetation burning?

"The only places we found charcoal were the campsites of the Clovis people, where they build their fires."

But where could the nanodiamonds come from?

Again, Haynes' colleague, Anthony Jull, had the answer. A common ingredient of cosmic dust, nanodiamonds are constantly raining down onto the earth's surface, rendering them unsuitable as unequivocal evidence of an extraterrestrial impact.

"Something happened 13,000 years ago that we do not understand," said Haynes. "What we can say, though, is that all of the evidence put forth in support of the impact scenario can be sufficiently explained by earthly causes such as climate change, overhunting or a combination of both."

Does this mean the results obtained by Haynes and his coworkers rule out the possibility of a cosmic event?

"No, it doesn't," Haynes said. "It just doesn't make it very likely."

The co-authors of the study are: Jennifer Boerner (formerly at the UA's department of geosciences), Kenneth Domanik, Dante Lauretta and Julia Goreva from UA's Lunar and Planetary Laboratory in the department of planetary sciences and Jesse Ballenger in UA's School of Anthropology.

More information: Paper: www.pnas.org/content/107/9/4010.abstract

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