

Topper site in middle of comet controversy

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(Phys.org)—Did a massive comet explode over Canada 12,900 years ago, wiping out both beast and man in North America and propelling the earth back into an ice age?

That's a question that has been hotly debated by scientists since 2007, with the University of South Carolina's Topper archaeological site right in the middle of the [comet impact](#) controversy. However, a new study published today in the *Proceedings of the National Academy of Sciences* (PNAS) provides further evidence that it may not be such a far-fetched notion.

Albert Goodyear, an archaeologist in USC's College of Arts and Sciences, is a co-author on the study that upholds a 2007 PNAS study by Richard Firestone, a staff scientist at the Department of Energy's

Lawrence Berkeley National Laboratory.

Firestone found concentrations of spherules (micro-sized balls) of metals and nano-sized diamonds in a layer of sediment dating 12,900 years ago at 10 of 12 archaeological sites that his team examined. The mix of particles is thought to be the result of an extraterrestrial object, such as a comet or meteorite, exploding in the earth's atmosphere. Among the sites examined was USC's Topper, one of the most pristine U.S. sites for research on Clovis, one of the earliest [ancient peoples](#).

"This independent study is yet another example of how the Topper site with its various interdisciplinary studies has connected ancient human archaeology with significant studies of the Pleistocene," said Goodyear, who began excavating Clovis artifacts in 1984 at the Topper site in Allendale, S.C. "It's both exciting and gratifying."

[Younger-Dryas](#) is what scientists refer to as the period of extreme cooling that began around 12,900 years ago and lasted 1,300 years. While that brief ice age has been well-documented – occurring during a period of progressive solar warming after the [last ice age](#) – the reasons for it have long remained unclear. The extreme rapid cooling that took place can be likened to the 2004 sci-fi blockbuster movie "The Day After Tomorrow."

Firestone's team presented a provocative theory: that a major impact event – perhaps a comet – was the catalyst. His copious sampling and detailed analysis of sediments at a layer in the earth dated to 12,900 years ago, also called the Younger-Dryas Boundary (YDB), provided evidence of micro-particles, such as iron, silica, iridium and nano-diamonds. The particles are believed to be consistent with a massive impact that could have killed off the Clovis people and the large North American animals of the day. Thirty-six species, including the mastodon, mammoth and saber-toothed tiger, went extinct.

The scientific community is rarely quick to accept new theories. Firestone's theory and support for it dominated the annual meeting of the American Geophysical Union and other gatherings of Paleoindian archaeologists in 2007 and 2008.

However, a 2009 study led by University of Wyoming researcher Todd Surovell failed to replicate Firestone's findings at seven Clovis sites, slowing interest and research progress to a glacial pace. This new PNAS study refutes Surovell's findings with its lack of reported evidence.

"Surovell's work was in vain because he didn't replicate the protocol. We missed it too at first. It seems easy, but unless you follow the protocol rigorously, you will fail to detect these spherules. There are so many factors that can disrupt the process. Where Surovell found no spherules, we found hundreds to thousands," said Malcolm LeCompte, a research associate professor at Elizabeth City State University and lead author of the newly released PNAS article.

LeCompte began his independent study in 2008 using and further refining Firestone's sampling and sorting methods at two sites common to the three studies: Blackwater Draw in New Mexico and Topper. He also took samples at Paw Paw Cove in Maryland, a site common to Surovell's study.

At each site he found the same microscopic spherules, which are the diameter of a human hair and distinct in appearance. He describes their look as tiny black ball bearings with a marred surface pattern that resulted from being crystalized in a molten state and then rapidly cooled. His investigation also confirmed that the spherules were not of cosmic origin but were formed from earth materials due to an extreme impact.

LeCompte said it was Topper and Goodyear's collaboration, however, that yielded the most exciting results.

"What we had at Topper and nowhere else were pieces of manufacturing debris from stone tool making by the Clovis people. Topper was an active and ancient quarry at the time," LeCompte said. "Al Goodyear was instrumental in our approach to getting samples at Topper."

Goodyear showed LeCompte where the Clovis level was in order to accurately guide his sampling of sediments for the Younger Dryas Boundary layer. He advised him to sample around Clovis artifacts and then to carefully lift them to test the sediment directly underneath.

"If debris was raining down from the atmosphere, the artifacts should have acted as a shield preventing spherules from accumulating in the layer underneath. It turns out it really worked!" Goodyear said. "There were up to 30 times more spherules at and just above the Clovis surface than beneath the artifacts."

LeCompte said the finding is "critical and what makes the paper and study so exciting. The other sites didn't have artifacts because they weren't tool-making quarries like Topper."

While the comet hypothesis and its possible impact on Clovis people isn't resolved, Goodyear said this independent study clarifies why the Surovell team couldn't replicate the Firestone findings and lends greater credibility to the claim that a major impact event happened at the Younger Dryas Boundary 12,900 years ago.

"The so-called extra-terrestrial impact hypothesis adds to the mystery of what happened at the YDB with its sudden and unexplained reversion to an ice age climate, the rapid and seemingly simultaneous loss of many Pleistocene animals, such as mammoths and mastodons, as well as the demise of what archaeologists call the Clovis culture," Goodyear said. "There's always more to learn about the past, and Topper continues to function as a portal to these fascinating mysteries."

The Topper story

Albert Goodyear, who conducts research through the University of South Carolina's S.C. Institute of Anthropology and Archaeology, began excavating Clovis artifacts along the Savannah River in Allendale County in 1984. It quickly became one of the most documented and well-known Clovis sites in the United States. In 1998, with the hope of finding evidence of a pre-Clovis culture earlier than the accepted 13,100 years, Goodyear began focused excavations on a site called Topper, located on the property of the Clariant Corp.

His efforts paid off. Goodyear unearthed small tools such as scrapers and blades made of the local chert that he believed to be tools of an ice age culture back some 16,000 years or more. His findings, as well as similar ones yielded at other pre-Clovis sites in North America, sparked great change and debate in the scientific community.

Goodyear reasoned that if Clovis and later peoples used the chert quarry along the Savannah River, the quarry could have been used by even earlier cultures.

Acting on a hunch in 2004, Goodyear dug even deeper into the Pleistocene terrace and found more artifacts of a pre-Clovis type buried in a layer of sediment stained with charcoal deposits. Radiocarbon dates of the burnt plant remains yielded ages of 50,000 years, which suggested man was in South Carolina long before the last ice age.

Goodyear's findings not only captured international media attention, but it has put the archaeology field in flux, opening scientific minds to the possibility of an even earlier pre-Clovis occupation of the Americas.

Since 2004, Goodyear has continued his Clovis and pre-Clovis excavations at Topper. With support of Clariant Corp. and SCANA, plus

numerous individual donors, an expansive shelter and viewing deck now sit above the dig site to allow Goodyear and his team of graduate students and public volunteers to dig free from the heat and rain and to protect what may be the most significant early-man dig in America.

The Topper timeline

1998 Goodyear and his team dig to a meter below the Clovis level and encounter unusual stone tools up to 2 meters below the surface.

1999 Team of outside geologists visit Topper site and propose a thorough geological study of the location.

2000 Geological study done is by consultants; ice age sediment is confirmed for pre-Clovis artifacts.

2001 Geologists revisit Topper and obtain ancient plant remains deep in the Pleistocene terrace. Optically stimulated luminescence (OSL) dates sediment above ice-age strata show pre-Clovis is at least older than 14,000 years.

2002 Geologists find new profile showing ancient sediment lying between Clovis and pre-Clovis, confirming the age of [ice age](#) sediment layer between 16,000 – 20,000 years.

2003 Archaeologists continue to excavate pre-Clovis artifacts above the Pleistocene terrace. New and significant Clovis artifacts are found.

2004 Goodyear discovers major Clovis occupation on the hillside. Additionally, radiocarbon dates for sediment associated with pre-Clovis artifacts come back at 50,000 years.

2005 "Clovis in the Southeast" conference held in Columbia, S.C., with tours of Topper and Big Pine Tree sites.

2006 The 3,500-square-foot roofed structure is built over pre-Clovis excavations.

2007 Firestone study about a possible Clovis comet is published in the Proceedings of the National Academy of Sciences, including evidence from Clovis age sediments from Topper.

2008 PBS "Time Team America" spends a week at Topper filming for

an hour-long television special devoted to Topper.

2008 SCETV broadcast of "Finding Clovis," a public television presentation of Topper Clovis. 2009 PBS "Time Team America" program airs.

2011 Topper and Big Pine Tree included in a study of post-Clovis Paleoindian decline/reorganization that is published in the journal "Quaternary International."

2011 The first permanent exhibit of Topper artifacts installed at the University of South Carolina Salkehatchie.

2012 Independent study of micro-spherules related to an extra-terrestrial impact hypothesis is published in the [Proceedings of the National Academy of Sciences](#) using Clovis-age sediments from Topper that confirm the original 2007 Firestone study.

2013 The pre-Clovis occupation of Topper will be presented in October at the international conference on the peopling of the Americas, titled "Paleoamerican Odyssey," in Santa Fe, N.M.

www.paleoamericanodyssey.com/

Provided by University of South Carolina

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