

BLAST IN THE PAST?

A controversial new idea suggests that a big space rock exploded on or above North America at the end of the last ice age. **Rex Dalton** reports.

Around 13,000 years ago, North America was a busy place. Millennia of ice sheets had melted away, and humans crossed from Siberia to Alaska, spreading from the Canadian woods to the lush Carolina coastline. But after just two centuries of hunting mammoth, bison and horse, this 'Clovis' culture suddenly disappeared¹, posing one of the great anthropological questions of the peopling of the Americas: why did the New World's most sophisticated hunters of the time suddenly vanish?

Now, a team of researchers is invoking an out-of-this-world cause. On 24 May, at the American Geophysical Union's meeting in Acapulco, Mexico, some two dozen scientists will present multiple studies arguing that a comet or asteroid exploded above or on the northern ice cap almost 13,000 years ago — showering debris across the continent and causing temperatures to plunge for the next millennium.

The history of geology is peppered with such notions — from the 'cosmic serpent' theory that the outer planets nudge comets onto a collision path with Earth, to the idea that an impact could have caused the collapse of Bronze-Age civilizations. Most of these theories have never become widely accepted by the scientific community. But the new team argues that its idea explains multiple observations: not only the climate cooling and the disappearance of the Clovis hunters, but also the near-simultaneous extinction of the continent's large mammals.

"The magnitude of this discovery is so important," says team member James Kennett, a palaeoceanographer at the University of California, Santa Barbara (UCSB). "It explains three of the highest-debated controversies of recent decades."

Not all will be convinced. Several lead-



The black layer in these sediments at Murray Springs may be remnants of fires after a meteorite impact.

ing hypotheses already explain each of these three events. A change in ocean circulation is generally thought to have brought about the onset of the millennium-long cooling, which is known as the Younger Dryas. This cooling might, in turn, have caused the Clovis hunters to disappear. And, if they had not previously been killed by disease or hunted to extinction, the big prehistoric beasts may also have been doomed by this change in climate.

The new evidence comes in the form of geochemical analysis of sedimentary layers at 25 archaeological sites across North America — 9 of them Clovis.

Certain features of the layers, say the team, suggest that they contain debris formed by an extraterrestrial impact. These include spherules of glass and carbon, and amounts

of the element iridium said to be too high to have originated on Earth. In addition, the rocks contain black layers

of carbonized material, which the team says are the remains of wildfires that swept across the continent after the impact.

Other experts are waiting to see how the data pan out. Vance Haynes, an archaeologist at the University of Arizona who has studied the Clovis people for more than 40 years, says the new theory could be viable. "If their geological analysis can be replicated by another group," he says, "it would make it believable."

"Their impact theory shouldn't be dismissed; it deserves further investigation," says Jeff Severinghaus, a palaeoclimatologist at the Scripps Institution of Oceanography in La Jolla, California, who studies ice cores. But he thinks it "very, very unlikely that such an event could have led to climate change", scepticism based on analysis of ice cores from Greenland, which show that some cooling had begun earlier².

A rocky road

Duncan Steel, an Australian asteroid expert, has seen many groups try to connect impacts with major cultural changes. In this case, he says, "the researchers make at least a prima facie case for a link."

Team members know they have a lot of scepticism to overcome. Many of them have signed on tentatively, saying they find the idea intriguing if not yet compelling. When Kennett heard of the theory, he says he thought: "This really makes sense. But it needs to be examined carefully."

Earlier theories about what caused the Younger Dryas held that it was a temporary



Caught knapping: were early Americans killed by a space rock?

reversal of the global warming trend that brought the Clovis people to the Americas in the first place, across a land bridge from Siberia. At that time, North America's climate was warming and its land was being revealed by the melting of a massive ice cap that at its extreme, about 22,000 years ago, reached into what is now the heartland of the United States. Melt-water running off the ice cap fed a huge body of freshwater known as Lake Agassiz, which stretched across the upper Midwest.

At some point, the idea goes, Lake Agassiz breached a natural dam and began rushing into the North Atlantic. The rapid addition of freshwater effectively slowed down the ocean conveyor system that transports heat north from the mid-latitudes³. The climate cooled for about a millennium, then gradually warmed again as the Atlantic returned to more normal conditions.

Fire and ice

In place of the Lake Agassiz breach, the new theory estimates that an object up to 5 kilometres across hit the northern ice cap, causing melting and the flood into the North Atlantic. No obvious crater remains behind — perhaps, suggest those proposing the theory, because the space rock exploded in the air, or because the ice cap was thick enough to mask the impact.

The theory came together over several years, evolving with a number of twists. In Michigan in the late 1990s, archaeologist William Topping was working on a Clovis campsite known as Gainey. Topping had been exploring a theory that the Younger Dryas was caused by a nearby supernova, or exploding star. In 2001, he and Richard Firestone, a nuclear physicist at Lawrence Berkeley National Laboratory in California, published an article to that effect with data from the sediments at Gainey⁴.

Critics immediately questioned the work, and after further analysis Firestone withdrew the claim. But Topping, still wedded to the supernova idea, disagreed; the two parted ways thereafter.

Firestone eventually joined forces with Kennett, but both give primary credit to their colleague Allen West, a self-taught geophysicist in Arizona who collected many of the new samples. "West is the champion," says Kennett.

Today, Kennett groans at the mention of the since-corrected 2001 article, but says he is fully committed to the quality of the new studies. "I'm not going to jump on some project that's not supported by sufficient data," he says. "And this project is data-driven."

Some of the data come from a Clovis site known as Murray Springs, located in southeastern Arizona and long-studied by Haynes. The sediments there include the 'black mat' of carbon layers laid down just before the onset of the Younger Dryas. Beneath that layer, West found samples of carbon spherules, ranging from 0.15–2.5 millimetres across, some of which were hollow. Firestone and West argue that similar spherules have been found at a crater in Germany, and could be remnants of an impact.

The team also retrieved samples of glassy-looking carbon, with textures they say suggest melting during an impact, as well as layers enriched in iridium, an element not found in abundance on Earth. And team member Luann Becker, of UCSB, who was previously involved in controversial claims that an asteroid caused the Permian-Triassic extinction about 250 million years ago⁵, says in an abstract for the Acapulco meeting that she has found fullerenes in layers at Clovis sites — possible support for an impact event.

Team members say that they have found at least some of these markers in 25 widely scattered sites across the continent. Kennett, for instance, found spherules in 12,900-year-old sediments on Santa Rosa Island, which lies off the Californian coast and is the site of the oldest human bones found so far in North America. Other potential evidence for an impact at the



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— James Kennett

time comes from neighbouring San Miguel Island. "These gave us the best examples from the West Coast," says Kennett.

In the east, the team scrutinized a series of circular depressions that run from Georgia to Delaware. Known as the Carolina Bays, the way in which they were created has been the subject of much debate; impacts are one idea among many. Firestone thinks the bays may be craters left by debris from a Clovis-era explosion, although others remain to be convinced.

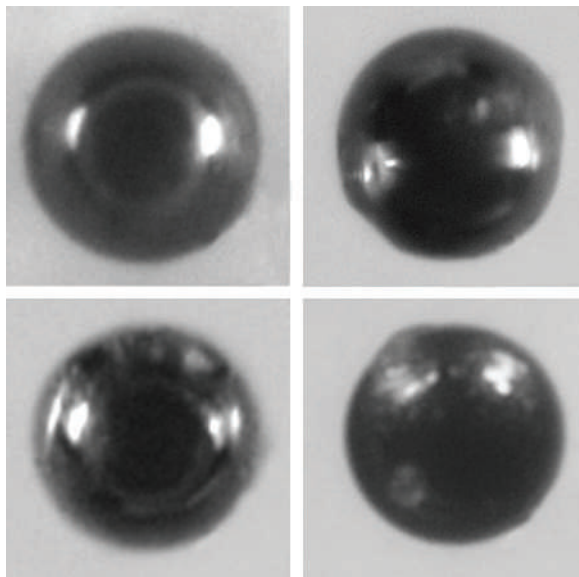
Decline and fall

Near the bays, in South Carolina, the team has also been looking for evidence at a Clovis site known as Topper. Clovis points are abundant in this region. But Albert Goodyear, an archaeologist at the University of South Carolina at Columbia, will report in Acapulco that there was a sharp decline in Clovis points at Topper during the Younger Dryas. This, the team argues, is evidence that at that time humans went through some sort of population collapse. But other archaeologists say they have no evidence of a similar decline in other Palaeoindian populations; even as the Clovis culture was disappearing, other cultures arose in its place, for reasons not entirely understood.

In the end, the Acapulco meeting may cause other scientists to re-examine their evidence for what was happening in North America at the end of the last ice age. For instance, Paul Mayewski, an ice-core expert at the University of Maine in Orono, is investigating ice cores from Greenland that show a massive burning event occurred around the start of the Younger Dryas. Others will undoubtedly start digging through whatever records they have of the time. And, at the end of the Acapulco session, the team will host a dinner — throwing open the doors for critics and supporters alike to begin talking through the theory. It will be interesting to see where it goes. ■

Rex Dalton is Nature's US West Coast correspondent.

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Magnetic microspherules, reportedly evidence of an extraterrestrial impact, have been found at sites across North America.

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