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New Evidence of Meteor Bombardment

By KENNETH CHANG

At least once in Earth's history, global warming ended quickly, and scientists have long wondered why.

Now researchers are reporting that the abrupt cooling — which took place about 12,900 years ago, just as the planet was emerging from an ice age — may have been caused by one or more meteors that slammed into North America.

And that could explain the extinction of mammoths, saber-tooth tigers and maybe even the first human inhabitants of the Americas, the scientists report in Friday's issue of the journal Science.

The hypothesis has been regarded skeptically, but its advocates now report perhaps more convincing residue of impact: a thin layer of microscopic diamonds found in rocks across America and in Europe.

"We're up over 30 sites, as far west as offshore California, as far east as Germany," said Allen West, a retired geology consultant who is one of the scientists working on the research.

The meteors would have been smaller than the six-mile-wide one that struck the Yucatán peninsula 65 million years ago and led to the mass extinctions of the dinosaurs. The killing effects of the hypothesized bombardment 12,900 years ago would have been more subtle.

Climatologists believe that the direct cause of the 1,300-year cold spell, known as the Younger Dryas, was a sudden rush of fresh water from a giant lake in central Canada to the North Atlantic.

Usually a surface current of warm water flows northward in the Atlantic toward Greenland and Europe, then cools and sinks, returning south in the deep ocean. But the fresh water, which is less dense, blocked the sinking of the cold, salty water in the North Atlantic, disrupting the currents.

That sudden change in plumbing has long been known, but what caused it has never been satisfactorily explained.

The authors of the Science paper say it was meteors.

At each site the scientists looked at, the diamond layer in the rocks correlates to the date of the hypothesized impact. Within the layer, the scientists report finding a multitude of diamond particles, all encased within carbon spheres. "We've yet to find a single diamond above it," Dr. West said. "We've yet to find a single diamond below it."

Perhaps more telling, the scientists reported last month at a meeting of the American Geophysical Union in

San Francisco, the carbon atoms inside some of the diamonds are lined up in a hexagonal crystal pattern instead of the usual cubic structure. The hexagonal diamonds, formed by extraordinary heat and pressure, have been found only at impact craters and within meteorites and cannot be formed in forest fires or volcanic eruptions, Dr. West said.

Last year the scientists presented other evidence of an impact, including elevated levels of the element iridium.

At least some skeptics are not convinced. “The whole thing still does not make sense, and there are lots of contradictions,” said Christian Koeberl, a professor of geological sciences at the University of Vienna in Austria.

His chief reservation: there’s no crater. “A body of this size does not just blow up without a trace in the atmosphere,” Dr. Koeberl said. “Physics won’t have it.”

Proponents have suggested that the meteor hit an ice sheet a couple of miles thick or that there were a series of smaller objects that exploded in the air. But Dr. Koeberl said something hitting an ice sheet would still generate a hole in the ground underneath, and he questioned whether smaller impacts or air explosions would produce the shock waves needed to make diamonds.

An impact should also have left remnants of melted rocks and shocked minerals, he said.

But if true, the hypothesis could explain the disappearance of Ice Age mammals like mammoths and argue against the alternative idea that the animals were hunted to extinction by humans.

It might also help explain the disappearance of the Clovis people, a culture named after a distinctive arrow point discovered in a mammoth skeleton in Clovis, N.M., who are believed to have arrived in the Americas more than 13,000 years ago.

Douglas J. Kennett, a University of Oregon archaeologist who is the lead author of the Science paper, said no Clovis points or bones of the extinct animals had been found above the diamond layer. “It seems those two things synchronously end,” he said.

Dr. Kennett said there also appeared to be a gap of several centuries between the disappearance of the Clovis and the resettlement by other people.

Gary Huss, a scientist at the University of Hawaii, Manoa, who was one of the early reviewers of the Science paper, said that while the scientists had not proved their case, they had offered enough evidence that the idea warranted a closer look by others.

“They have a hypothesis that explains several things that hard to explain any other way,” he said. “Diamonds are less convincing by themselves, but they strengthen their case considerably.”