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## Asteroid theory gains ground

### Impact probably did in the dinosaurs, new study says

By **Katy Human, Camera Staff Writer**  
**January 16, 2003**

Dinosaurs probably died because of an asteroid impact — the dust, dead plants and global wildfires caused by the giant collision — and not because of ancient volcanic eruptions or climate change, according to a new study by scientists in Colorado, Pennsylvania and Washington, D.C.

Although many paleontologists have come to believe the asteroid impact theory in recent years, some remained convinced that changes in the weather about 65 million years ago doomed the dinosaurs, said Kirk Johnson, a paleobotanist at the Denver Museum of Nature and Science.

Others simply thought the asteroid theory was too clean and simple, said Johnson, co-author of a paper published last week in the Proceedings of the National Academy of Sciences.

"We've shown how complicated the world was back then ... and even with that, the asteroid comes out clearly," he said.

The new study lends more credibility to the asteroid theory by showing that climate change did not affect dinosaur survival.

Pat Holroyd, a vertebrate paleontologist at the University of California, Berkeley's Museum of Paleontology and a colleague of Johnson and his co-authors, said she thinks the paper is a "very important" one.

"Time will tell if it helps answer all our questions," she said. "We'll need to talk about it in meetings, see if this works worldwide ... but this sets the standard for studies elsewhere."

Johnson and his colleagues — Peter Wilf at Pennsylvania State University and Brian Huber at the Smithsonian Institution — studied fossils of plants and ocean animals for detailed information about climate changes in the million years or so before and after the dinosaurs' demise.

For the plant-based climate record, Johnson pored through 22,000 plant fossils excavated from a North Dakota site known to straddle the Cretaceous-Tertiary boundary, when dinosaurs died. Leaf shapes are directly related to climate, he said.



Carmel Zucker

Kirk Johnson, a paleobotanist at the Denver Museum of Nature and Science, holds a 66 million-year-old leaf fossil from South Dakota at the museum Wednesday. Johnson used leaf fossils to measure the Earth's temperature at different times in history.

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Huber looked at the fossils of tiny marine animals called foraminifera, which record temperatures in another way. And both scientists linked their climate data to real dates with a geological trick related to the planet's shifting magnetism. Wilf pulled the data together, Johnson said.

"The curves matched, and they showed this neat pattern of climate change," he said. "A half-million years before the asteroid hit, we see a strong chug of global warming, probably linked to volcanic eruptions in India."

Volcanoes spew carbon dioxide, a greenhouse gas, into the atmosphere, he explained. Some researchers suggest that volcano-caused climate change killed the dinosaurs.

"Then just before the hit, 100,000 years before, there's a strong cooling, and it (the temperature) drops back down to the level it was at before," Johnson said.

But during the major climate swing, little changed on land, he said. "There were still crocodiles in the Arctic ... and we had the same dinosaur community here in North America: tyrannosaurus, triceratops, the duckbills."

Yet when the giant asteroid struck, every land animal bigger than a dog died, and 50 percent to 80 percent of plants — the base of the food chain on land — disappeared.

"This starts to take volcano and climate out of the argument," Johnson said.

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