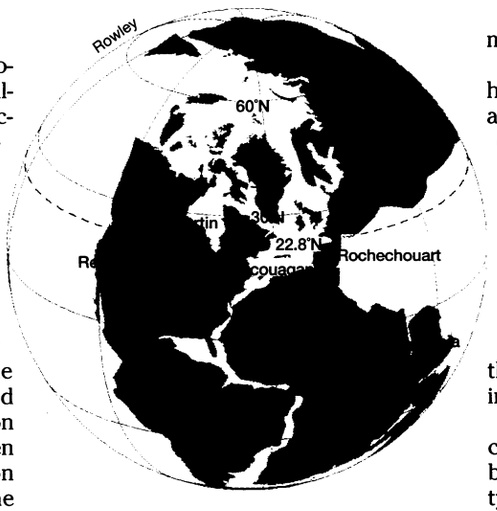
charismatic character.

The close of the Triassic period is notorious among paleontologists as a tumultuous time. One of the five biggest extinction events in the fossil record, the late-Triassic crisis wiped out the dominant reptiles of the time and helped spur the rise of a hitherto minor group called the dinosaurs, which went on to dominate Earth for 150 million years.

On closer inspection, however, the neat story line dissolves. The biggest burst of extinctions took place at the boundary between the Triassic and Jurassic periods, just about 202 million years ago, says paleontologist Paul Olsen of Lamont-Doherty. Some 12 million years separate the impacts from the most prominent Triassic die-offs.

Spray and his colleagues suggest a tentative link between the impacts and an earlier wave of extinctions, which occurred at the boundary between the Carnian and Norian stages of the Triassic. Geologists have not dated this time precisely, he says. "Although it is generally held to be 220 million years ago, it could easily be close to 214 million," contends Spray.

Paleontologist Michael J. Benton of the University of Bristol in England disputes that point. "Nobody has suggested [the Carnian stage] goes to 214. There is no secondary evidence that impacts had anything to do with the Carnian-Norian extinctions."



A map of the late Triassic period shows outlines of the modern continents and five approximately contemporary craters (circles). An arc through the Rochechouart and Obolon craters runs roughly parallel to an arc passing through the Saint Martin and Red Wing craters.

Olsen echoes the skepticism. The age of the Manicouagan crater, he says, "falls in the middle of the Norian, but there is no evidence of anything going on in the middle Norian. There are no extinctions."

Geologists might find the lack of association even more interesting than a link between the impacts and extinctions. A string of five large body blows to Earth may not be enough to knock life for a loop.

The Manicouagan crater is a little over half the size of the Chicxulub crater, but according to impact theories, it is large enough to cause many of the same effects. With Manicouagan and the other four craters, says Spray, the energy released in that series of strikes should compare with the large Cretaceous collision.

Many researchers, however, are starting to think that size does not matter—above a certain point. Location may be the more important factor in determining the killing potential of a large impact.

By this rationale, the Cretaceous crash claimed so many species because the body slammed into a relatively rare rock type, a thick carbonate platform loaded with sulfur-rich rock. The crash filled the atmosphere with tiny, light-blocking sulfuric acid droplets, which eventually dropped into the oceans and turned the surface waters toxic. Carbon liberated during the crash enhanced Earth's greenhouse effect and warmed the planet.

"I'm beginning to think that Chicxulub might be unique because of the target rocks and all the sulfur that went into the atmosphere," says Grieve.

If Earth suffered several simultaneous hits 214 million years ago with few lasting biological effects, then scientists may have overdramatized the threats of life-ending strikes from space. That lesson, however, will not make a splash in Hollywood. □

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female who is synchronized with her competitors can be reasonably assured that the alpha male will not impregnate them.

Eric Carlisle
Dallas, Texas

Local feedback on LTER

"Ecologists Go to Town" (SN: 4/4/98, p. 219) missed a critical component of the Baltimore Urban LTER's success.

The Baltimore LTER is made up primarily of local co-principal investigators and their staffs at Johns Hopkins University, the University of Maryland at College Park, and the University of Maryland, Baltimore County, where the LTER research office, site manager, and staff are located. In addition, significant staff and resources are being provided by the local offices of the U.S. Geological Survey, the Bureau of the Census, the Environmental Protection Agency, and NASA's Office of Earth Science. Participation by state, county, and city agencies, as well as others has also been a major help in data acquisition and logistics.

These local institutions and researchers and their spirit of cooperation are what make the Baltimore LTER a candidate for long-term success in integrating the social, ecological, and physical disciplines for understanding urbanized areas as ecosystems.

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