Rethinking Early Mass Extinctions

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UCSB scientists challenge past extinction theories.

Scientists have enough trouble agreeing on what's happening around the world today in terms of species extinction. Imagine how murky that picture becomes as we travel hundreds of millions of years back in time.

Fossils and other geological time capsules are the key markers along the way, but reading those signs seems to leave plenty of room for individual interpretation among researchers.

Earlier this year, some UCSB scientists challenged the generally accepted views put forward to explain the widespread extinction of early life during glaciations between 726 and 635 million years ago.

It has long been thought that these glaciations are associated with a big drop in fossil diversity, suggesting a mass die-off at this time, perhaps due to the severity of the deep freeze.

However, Susannah Porter, assistant professor in UCSB’s Department of Earth Science, and her former graduate student Robin Nagy, have turned that theory on its head.

They analyzed microfossils from rocks near the bottom of the Grand Canyon and found evidence suggesting this drop in diversity occurred some 16 million or more years before the glaciations.

Together with colleagues from Utah State and the University of Quebec, they offer an
alternative theory for the decline of phytoplankton diversity, the spread of bacterial blooms, and the depletion of oxygen levels in the water.

John Alroy, a researcher with UCSB’s National Center for Ecological Analysis and Synthesis (NCEAS), has also been scrambling some long-held ideas.

He was principal author of a report published last year that had 34 co-authors, contributions from hundreds of other researchers, a database of almost 285,000 fossil findings, and took 10 years of study.

By counting fossil records from all over the world, Alroy and his fellow researchers concluded that much of what experts have been saying for the last 40 years about diversity peaks and troughs over the last 500 million years might not be accurate.

Alroy’s research has also led him to question the conventional wisdom that the world has experienced five mass extinctions in that time, and is now in a sixth. Instead, he believes only three past events can justifiably be called mass extinctions.

By Alroy’s reckoning we are now in only the fourth mass extinction, this one being driven by a host of causes including climate change, deforestation, pollution, overfishing and hunting, diseases, ocean acidification, and the rampant introduction of exotic species.

Meanwhile, a NOVA documentary on PBS television earlier this year presented another twist when UCSB geologist James Kennett offered a new theory for the sudden extinction of many of the large animals roaming North America about 13,000 years ago.

Kennett, professor emeritus in the Department of Earth Science, thinks the abrupt disappearance of woolly mammoths, saber-toothed big cats, giant ground sloths and other major species was caused by a cosmic impact, perhaps a comet hitting or exploding just above the Earth.

This hypothesis challenges at least three other theories: that Stone Age human hunters exterminated the large animals; that a short, sudden return to ice-age conditions killed off the megafauna; or that the animals were struck down by some virulent disease.

Kennett and his colleagues base their belief on the discovery of fossil remains just beneath—but never above—a widespread blanket of soil containing charcoal, soot,
billions of microscopic diamonds and other trace materials. (See below)

The type of shock-synthesized hexagonal nanodiamonds embedded in this layer are considered a reliable cosmic impact marker since they are found on Earth only in meteorites or at impact craters.

Kennett believes this layer, dubbed the 'black mat,' was laid down in the aftermath of a cosmic body striking North America or exploding above it, the force of which synthesized the microscopic diamonds, triggered huge wildfires and stirred up vast clouds of ash and dust.

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