Why the 'sixth extinction' will be unpredictable

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A major extinction event is under way – but predicting which species will survive could be harder than we thought. That's the conclusion of one of the most accurate analyses ever of diversity in the marine animal fossil record.

Conventional wisdom among palaeontologists has it a group of animals that has diversified rapidly will later tend to flourish and diversify more than others after an event that causes mass extinction, such as an asteroid impact or global warming. If true, this would help us predict the outcome of the current extinction, which is often dubbed the "sixth extinction".

Now an analysis by John Alroy of Macquarie University in Sydney, Australia, reveals that the principle does not hold. He used the Paleobiology Database of fossils, which holds data from nearly 100,000 collections, to study 20,181 genera of marine animals from 50 time periods, such as the Cambrian explosion more than 500 million years ago and the largest mass extinction event 250 million years ago.

He found that "all bets are off" for predicting what will happen to biological diversity after a major extinction event, he says.

"If you were standing around in the Cretaceous period, you would have no idea which groups would thrive and which would die out," he says.

Patternless pattern

Large diversity within a particular group does not predict survival. For example, the worm-like Conodonta and hard-shelled Linguliformea became hugely diverse in the Cambrian period, but had died out by the end of the Ordovician 430 million years ago. "The important overall pattern is no pattern," says Alroy.

Although the current extinction era is caused by human actions rather than natural events, the survival patterns should be similar, he adds.

Skewed effort

This is not the first time palaeontologists have attempted to plot the history of marine diversity – but it uses the greatest amount of fossil data, and Alroy claims it is the most accurate.

Previous attempts have suffered from sampling biases, writes Charles Marshall at the University of California, Berkeley, in an article accompanying Alroy's study.

For example, older genera were under-represented because older fossils are less likely than young ones to survive erosion and be found. And more samples may have been preserved in particular environments, further skewing results.

Alroy accounted for such distortions using a new sampling method called shareholder quorum

sampling, which mathematically "dampens" the data from sites where a lot of samples have been found, for instance. "You're giving a little less credit to some genera, because you know that you are missing others," he explains.

As this is a new statistical method which "needs to be further vetted", Alroy's results are "unlikely to be universally accepted", says Marshall, "but they help to pinpoint the critical issues."

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