Researchers say habitat loss and tropical cooling were to blame for mass extinction

April 10 2012, by Kimm Fesenmaier

Bedding surfaces covered in marine invertebrate fossils from the Late Ordovician. This photo shows part of the Ellis Bay Formation on Anticosti Island in Québec, Canada. Anticosti Island preserves one of the most fossiliferous and stratigraphically complete records through the Late Ordovician Mass Extinction in North America. Credit: Caltech

(Phys.org) -- The second-largest mass extinction in Earth's history coincided with a short but intense ice age during which enormous glaciers grew and sea levels dropped. Although it has long been agreed that the so-called Late Ordovician mass extinction—which occurred about 450 million years ago—was related to climate change, exactly how the climate change produced the extinction has not been known. Now, a team led by scientists at the California Institute of Technology (Caltech) has created a framework for weighing the factors that might have led to mass extinction and has used that framework to determine that the majority of extinctions were caused by habitat loss due to falling sea levels and cooling of the tropical oceans.

The work—performed by scientists at Caltech and the University of Wisconsin, Madison—is described in a paper currently online in the early edition of the *Proceedings of the National Academy of Sciences*.

The researchers combined information from two separate databases to overlay fossil occurrences on the sedimentary rock record of North America around the time of the extinction, an event that wiped out about 75 percent of marine species alive then. At that time, North America was an island continent geologists call Laurentia, located in the tropics.

Comparing the groups of species, or genera, that went extinct during the event with those that survived, the researchers were able to figure out the relative importance of several variables in dictating whether a genus went extinct during a 50-million-year interval around the mass extinction.

"What we did was essentially the same thing you'd do if confronted with a disease epidemic," says Seth Finnegan, postdoctoral scholar at Caltech and lead author of the study. "You ask who is affected and who is unaffected, and that can tell you a lot about what's causing the epidemic."

As it turns out, the strongest predictive factors of extinction on Laurentia were both the percentage of a genus's habitat that was lost when the sea level dropped and a genus's ability to tolerate broader ranges of temperatures. Groups that lost large portions of their habitat as ice sheets grew and sea levels fell, and those that had always been confined to warm tropical waters, were most likely to go extinct as a result of the rapid climate change.

"This is the first really attractive demonstration of how you can use multivariate approaches to try to understand extinctions, which reflect amazingly complex suites of processes," says Woodward Fischer, an assistant professor of geobiology at Caltech and principal investigator on the study. "As earth scientists, we love to debate different environmental and ecological factors in extinctions, but the truth is that all of these factors interact with one another in complicated ways, and you need a way of teasing these interactions apart. I'm sure this framework will be profitably applied to extinction events in other geologic intervals."

The analysis enabled the researchers to largely rule out a hypothesis, known as the record-bias hypothesis, which says that the extinction might be explained by a significant gap in the fossil record, also related to glaciation. After all, if sea levels fell and continents were no longer flooded, sedimentary rocks with fossils would not accumulate. Therefore, the last record of any species that went extinct during the gap would show up immediately before the gap, creating the appearance of a mass extinction.

Finnegan reasoned that this record-bias hypothesis would predict that the duration of a gap in the record should correlate with higher numbers of extinctions—if a gap persisted longer, more groups should have gone extinct during that time, so it should appear that more species went extinct all at once than for shorter gaps. But in the case of the Late Ordovician, the researchers found that the duration of the gap did not matter, indicating that a mass extinction very likely did occur.

"We have found that the Late Ordovician mass extinction most likely represents a real pulse of extinction—that many living things genuinely went extinct then," says Finnegan. "It's not that the record went bad and we just don't recover them after that."

The team used data about North American fossils from the public

Paleobiology Database as well as information about the sedimentary rock record from the Macrostrat Database developed by the University of Wisconsin, Madison. Along with Fischer and Finnegan, additional coauthors of the paper, "Climate change and the selective signature of the late Ordovician mass extinction" are Shanan Peters and Noel Heim of the University of Wisconsin, Madison. Finnegan will begin a new appointment at UC Berkeley in the fall. The work was supported by the Agouron Institute and the National Science Foundation.

Provided by California Institute of Technology

Citation: Researchers say habitat loss and tropical cooling were to blame for mass extinction (2012, April 10) retrieved 28 April 2024 from https://phys.org/news/2012-04-habitat-loss-tropical-cooling-blame.html