

Patagonian fossil leaves reveal rapid recovery from dinosaur extinction event

November 7 2016



View of the Palacio de los Loros 2 fossil plant locality in Chubut, Patagonia, Argentina. The locality was deposited in the early Paleocene around 64 million years ago. Credit: Peter Wilf, Penn State

Ancient feeding marks from hungry insects in South American leaf

fossils are shedding new light on the mass extinction that wiped out the dinosaurs.

Scientists analyzed insect feeding damage to thousands of leaf fossils from Patagonia, Argentina, over the Cretaceous-Paleogene boundary, and found evidence that ecosystems there recovered twice as fast as in the United States.

The findings, published today (Nov. 7) in the new journal *Nature Ecology & Evolution*, offer important evidence of how terrestrial [ecosystems](#) outside the U.S. responded after an asteroid struck Chicxulub, Mexico, some 66 million years ago, marking the end of the Cretaceous period.

"Most of what we know about terrestrial recovery comes from the western interior United States, relatively close to the Chicxulub crater, which has limited our knowledge of recovery in the rest of the world," said Michael Donovan, doctoral student in geosciences, Penn State and lead author on the paper. "We are giving another view of what was happening during that time, far away from the impact site."

Donovan and his international team found leaf-mining insects completely disappeared in Patagonia during the extinction event, as previous studies show happened in the U.S. But unlike the U.S., where it took 9 million years to return to pre-impact insect diversity, recovery happened in just 4 million years in Patagonia.



Insect damage, including multiple small leaf mines (upper right) and margin feeding (upper left), on a fossil leaf from an early Paleocene fossil plant locality, Las Flores (62.52-62.22 Ma), in Patagonia, Argentina. Credit: Michael Donovan/Penn State

"Insects and plants are the most diverse multicellular organisms in the world, and they are known to respond to major environmental changes," Donovan said. "So they make a great resource to study our past."

The team analyzed 3,646 fossils from Patagonia searching for signs of leaf miners—insect larvae named for the type of damage they cause tunneling through leaves for food. These feeding paths, and the insects' droppings, both create distinctive patterns and can be compared among fossils at different sites.

"Michael developed this technique of very detailed examination of leaf miners, and new methods for looking at the critical differences among these feeding trails in fossil leaves," said Peter Wilf, professor of geosciences, Penn State and paper co-author. "He's teased apart this huge story from the tiny differences in how baby insects did their business in leaves that lived 66 million years ago."

The scientists found no evidence that individual leaf miner species from the Cretaceous survived the extinction event in Patagonia, indicating the far south did not offer a refuge for the insects as Donovan's team first hypothesized.

"There was no evidence of survival, which is similar to what I found when working on my master's research at the Mexican Hat site in

Montana," Donovan said. "But what we do find in Patagonia is a pretty diverse group of novel leaf miners that appear much sooner than in the western U.S."



Insect galls on a fossil leaf from the latest Cretaceous Lefipán Formation (67-66 Ma) in Patagonia, Argentina. Credit: Michael Donovan/Penn State

The researchers suggested Patagonia's further distance from the impact crater in Mexico and its ground zero effects could be responsible for insect diversity returning more rapidly to the southern location.

"The richness of plant-insect associations that we observed during the recovery may be a contributing factor to insect biodiversity in modern South America," Donovan said. "We can look far into the past and see these patterns that influence life on Earth as it is today."

Wilf said the study, the first of its kind outside the western U.S., can help scientists answer questions about modern global biodiversity.

"Our modern world is the legacy of this disaster," Wilf said. "As we try to understand how today's biodiversity evolved and why Earth's millions of species live where they do, the global impact of this major catastrophe is a big sleeping elephant in a dark room—we can't see much of it and just don't know enough about it. As we turn on the lights, we see more of the elephant and understand our world better. This paper is a welcome step in that direction."

More information: Michael P. Donovan et al. Rapid recovery of Patagonian plant–insect associations after the end-Cretaceous extinction, *Nature Ecology & Evolution* (2016). [DOI: 10.1038/s41559-016-0012](https://doi.org/10.1038/s41559-016-0012)

Provided by Pennsylvania State University

Citation: Patagonian fossil leaves reveal rapid recovery from dinosaur extinction event (2016, November 7) retrieved 22 June 2024 from <https://phys.org/news/2016-11-patagonian-fossil-reveal-rapid-recovery.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.