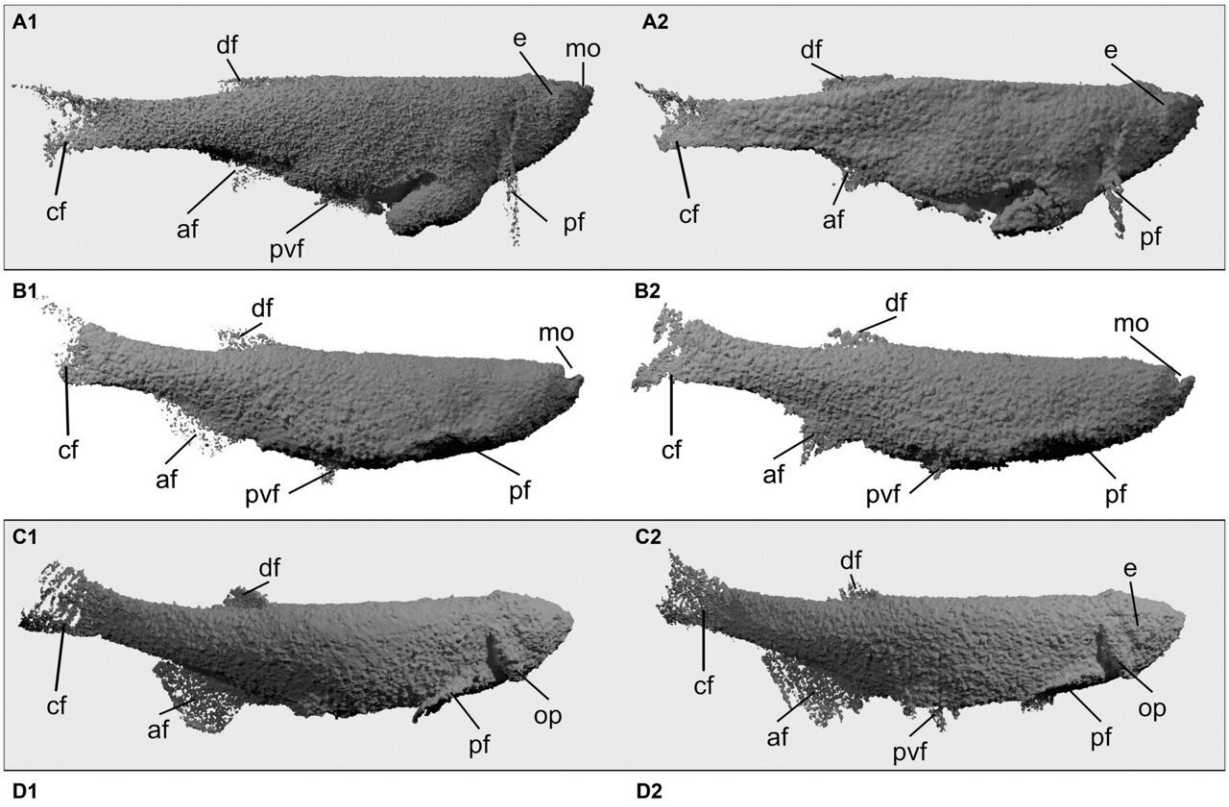
X-ray scanning reveals secrets of fossil formation without disturbing natural decay process

May 14 2025



3D XCT models of zebrafish in various stages of decay in right-lateral view. Credit: *Palaeontology* (2025). DOI: 10.1111/pala.70007

A new study published in *Palaeontology* has confirmed that X-ray

computed tomography (XCT scanning) can be used to monitor decomposing organisms without altering the natural decay process—a vital step in understanding how fossils form.

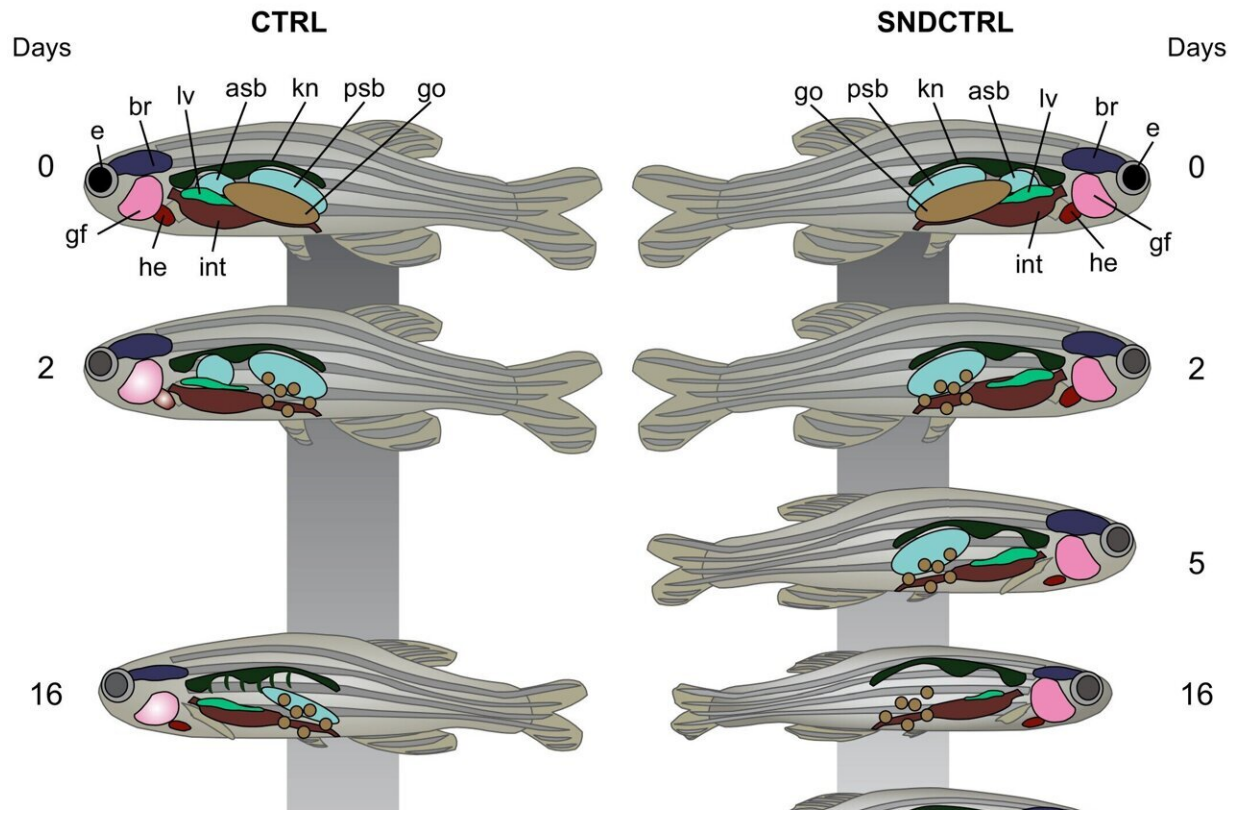
A research team from the University of Birmingham entombed dead zebrafish within sediment to test whether repeatedly zapping decaying specimens with X-rays would change how they decompose.

Their findings suggest this noninvasive imaging technique allows scientists to watch decay happen in real time without disturbing the process—unlike traditional methods that require digging up and potentially damaging specimens.

"It's like getting a snapshot of nature's natural recycling program," said Dr. Iacopo Cavicchini, lead author on the study. "Previous methods were like trying to observe a smelly bag of goop by digging it up—it's very difficult and you inevitably alter what you're trying to study."

The research addresses a significant challenge in taphonomy—the study of how organisms decay and become fossils. Traditional decay experiments require researchers to unearth specimens to observe them, causing artificial damage or disarticulation that can mess with the results.

In order to test if CT scanning could be used in their experiments, the research team wanted to know whether X-ray exposure would interfere with the bacteria that drive decay.



Visual representation of selected timestamps in the decay of zebrafish (Danio rerio) in the control experiments. Credit: *Palaeontology* (2025). DOI: 10.1111/pala.70007

Their findings showed that the microbes continued to decay the carcass, unimpeded by periodic exposure to X-rays—proving the technique serves as a crucial stepping stone toward more sophisticated noninvasive decay experiments that better mimic natural conditions of fossil formation.

"This study validates an important nondestructive tool for paleontologists and forensic scientists alike," said Dr. Thomas Clements, who supervised the project, now based at Friedrich-Alexander-Universität Erlangen-Nürnberg.

"We can now watch decay within sediments, providing unprecedented insights into the processes that ultimately create fossils."

Perhaps the most explosive finding in this study was the ability to witness—in high definition—the dramatic buildup of decomposition gases inside the fish carcasses before they eventually pop.

"We essentially created decaying fish fart surveillance," said Dr. Cavicchini, "which sounds silly until you realize it's providing crucial insights into how internal cavities collapse during fossilization."

More information: Iacopo Cavicchini et al, Investigating the impact of x-rays on decay: x-ray computed tomography as a non-invasive visualization technique for sediment-based decay experiments, *Palaeontology* (2025). DOI: 10.1111/pala.70007

Provided by University of Birmingham