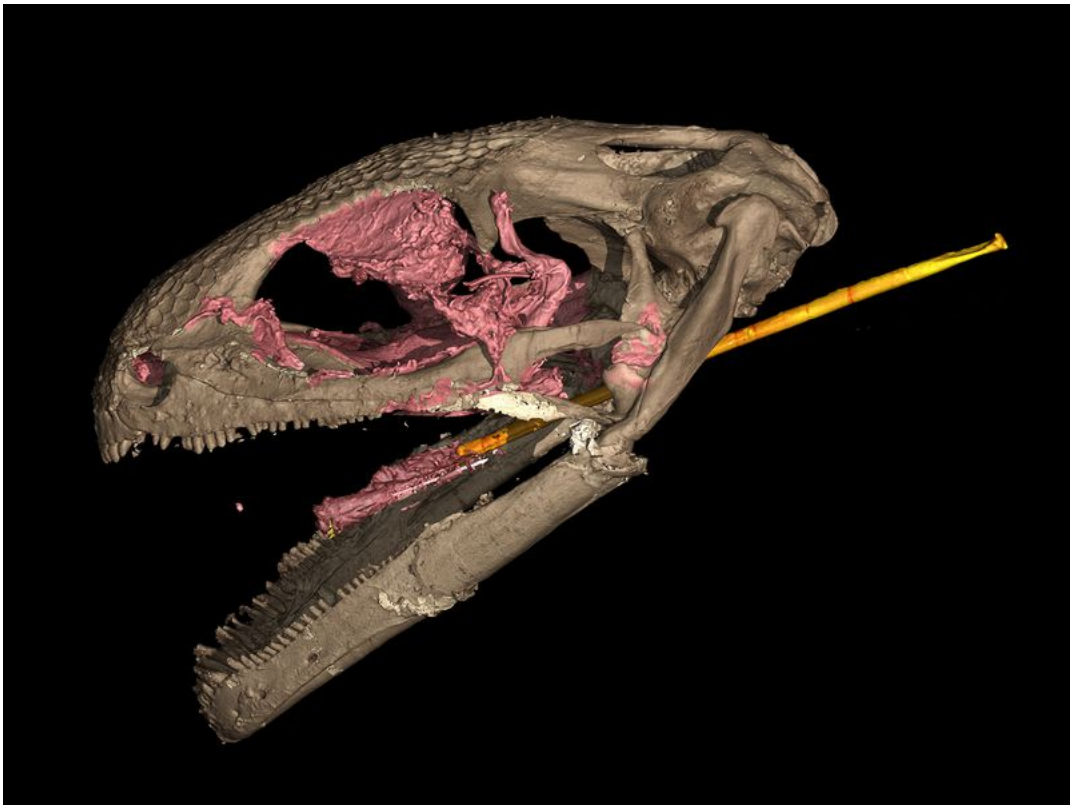
Scientists Find the World’s Oldest Chameleon-Like Tongue Preserved in Amber

A skull and soft tissue perfectly kept in resin show that an ancient amphibian had a tongue that was both fast and extendable



An extinct group of lizardlike amphibians known as albanerpetontids boasts the earliest example of a slingshot-style tongue. This CT scan shows an exquisitely preserved 99-million-year-old albanerpetontid skull with its long, specialized tongue. (Florida Museum of Natural History)

By Riley Black
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No creature alive today is quite like an albanerpetontid. Cousins of frogs and salamanders, these extinct amphibians have often confounded paleontologists by having scales and claws that make them look like reptiles. And “albies,” as some researchers call them, just got stranger. Preserved in 99 million-year-old amber is an albie skull with the world’s oldest known slingshot tongue.

The discovery, described today in *Science*, comes from a literal window into the ancient past. Fossilization in amber—or hardened tree sap—often preserves details that might otherwise rot away. The amber deposits of Myanmar, in particular, contain a vast array of Cretaceous creatures that lived in a 99 million-year-old forest, among them albanerpetontids. Three different fossils indicate that albies were not creatures that lived low to the ground, as previous fossils indicated, but crawled through the trees and nabbed insects with sticky tongues that could shoot out like projectiles.

Until now, precisely what albies are and how they lived has been clouded by a spotty fossil record. The oldest fossils of the group are over 165 million years old and the most recent are about 2 million years old, giving albies a range from the middle of the Jurassic through the beginning of the Ice Age. And based on fragmentary fossils, researchers thought that albies spent a lot of their time burrowing into the ground and looked like armored salamanders about four inches long. “Unlike living amphibians,” says Sam Houston State University paleontologist Juan Diego Daza, lead author of the study, “they have their bodies covered by epidermal scales and have keratinized claws.”

How these animals lived has been difficult to determine. “With rare exception, albanerpetontids are recovered as tiny, isolated and disarticulated bones,” says Smithsonian National Museum of Natural History paleontologist David DeMar, who was not involved with the new study. Without more complete material, scientists have had a difficult time telling what the entire animals would have looked like and how they would have behaved. The fossils in amber are the clearest look at these mystery animals yet.

The key fossil is a complete skull from an adult albie preserved in the resin. “All of us were astonished when we saw this fossil for the first time,” Daza says. The skull isn’t crumpled or smushed, but preserved in three dimensions with parts of the soft tissue intact. “The specimen provided the first evidence of parts of the skull that were unknown from previous specimens,” says University College London paleontologist Susan Evans, a coauthor on the new study, indicating how the skull had key similarities to some reptiles. In fact, one of the fossils was originally misidentified as an early chameleon.

Taken together, the various traits of the fossil indicate that the albies in amber is a new species. Daza, Evans and colleagues named it *Yaksha perettii*. But best of all, Evans says, the adult skull also preserves parts of the tongue and jaw muscles.

“These specimens are the next best thing to being able to travel back in time to study a living albanerpetontid,” says Royal Tyrrell Museum paleontologist James Gardner, who was not involved with the new study. Even a single, well-preserved fossil can rewrite what paleontologists previously thought, and that seems to be the case here.

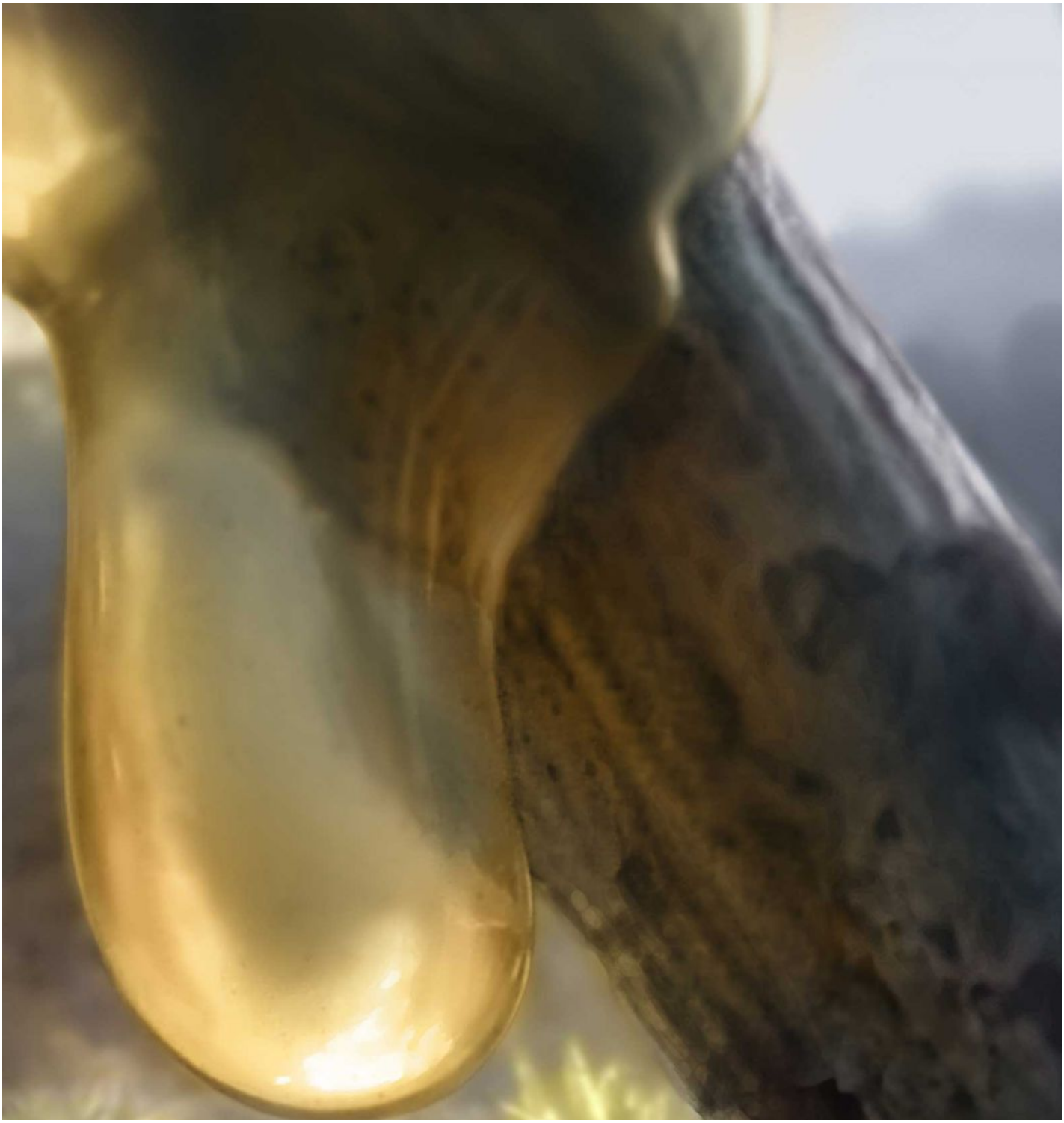
"As someone whose work over the past quarter century on albanerpetontids has largely focused on isolated bones," Gardner says, "I was both excited and humbled to see what a pristine skull really looked like."

Seeing the bones and bits of flesh in context, the researchers were able to determine that *Yaksha* had the oldest-known slingshot tongue. In addition to those soft tissue leftovers, the amphibian also preserves a long, thing bone called the entoglossal process that resembles the same bone in chameleons. The bone is important for shooting the tongue out to grab insects at a speed of over 1,600 feet per second, creating a natural elastic effect that can shoot the tongue out fast and then retract captured prey back to the mouth.

Daza, Evans and colleagues propose that all albies lived in a similar way. The claws, forward-facing eyes and other skeletal details of related species indicate that these animals were more like chameleons in habit than toads. "In external appearance," the researchers write in the new paper, "albanerpetontids probably resembled tiny lizards more than salamanders."

"The idea of albanerpetontids as chameleon-like, tree-dwelling, sit-and-wait predators is certainly a novel and exciting hypothesis," DeMar says. Thanks to a small set of fossils, these amphibians have moved from the ground to the trees. And while albies may remain rare, the *Yaksha* fossils will act as a keystone to compare future finds against.

"The authors make a convincing case," adds Gardner. Now that the Myanmar fossils have offered a better look at albanerpetontids, for instance, the rod-like bones seen in previously discovered fossils in Spain and Italy indicate similar, ballistic-tongued abilities. The question, Gardner says, is when albies evolved these traits, which will come into focus with new finds and reanalysis of previously-discovered fossils.



An albie uses it's rapid-fire tongue to capture prey. (Reprinted with permission from Daza et al., Science: 370: 687, 2020. Illustration by Stephanie Abramowicz)

These amber fossils are not without controversy. Insects, lizards, birds, parts of dinosaurs and other remnants of prehistoric life often fetch high prices from collectors, to the tune of millions of dollars every year. The Myanmar state of Kachin, where the amber comes from, has experienced much bloodshed between the government-run military and resistance forces over who controls the amber. The fossils are often gathered under unfair and dangerous working conditions before being smuggled out of country for sale, often with little information about how they were collected or who profits from their sale.

The ethical debate around these fossils was brought to the fore earlier this year when a supposed bird in Myanmar amber not only turned out to be a misidentified lizard, but had no documentation of ethical collection practices. Myanmar amber that makes it to market often lacks the necessary information to know how the pieces were collected and transported, and some paleontologists have been increasingly vocal that such undocumented finds should not be purchased or published on if scientists aren't sure about whether they may have fueled conflict.

But routes exist for the careful and ethical collection of these fossils. Guidelines set by the Society of Vertebrate Paleontology note that researchers should follow "rigorous standards of due diligence to their supply chains, and supply chains must be clearly documented to ensure that products are not derived from the Myanmar military." Scientists should record not just the identity of the fossil, but where it came from, when it was collected, who transported it to the marketplace, how the fossil was exported and where the fossil will remain for future studies. The authors of the new study state that they worked with these guidelines to make sure the albies did not add profit to the bloodshed in Myanmar.

In the case of the amber-enclosed albies, the fossils will provide context for how the enigmatic amphibians lived for years to come. "These specimens and CT scans will provide a continuing wealth of anatomical information for future studies," DeMar says.

About Riley Black

Riley Black is a freelance science writer specializing in evolution, paleontology and natural history who blogs regularly for .

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