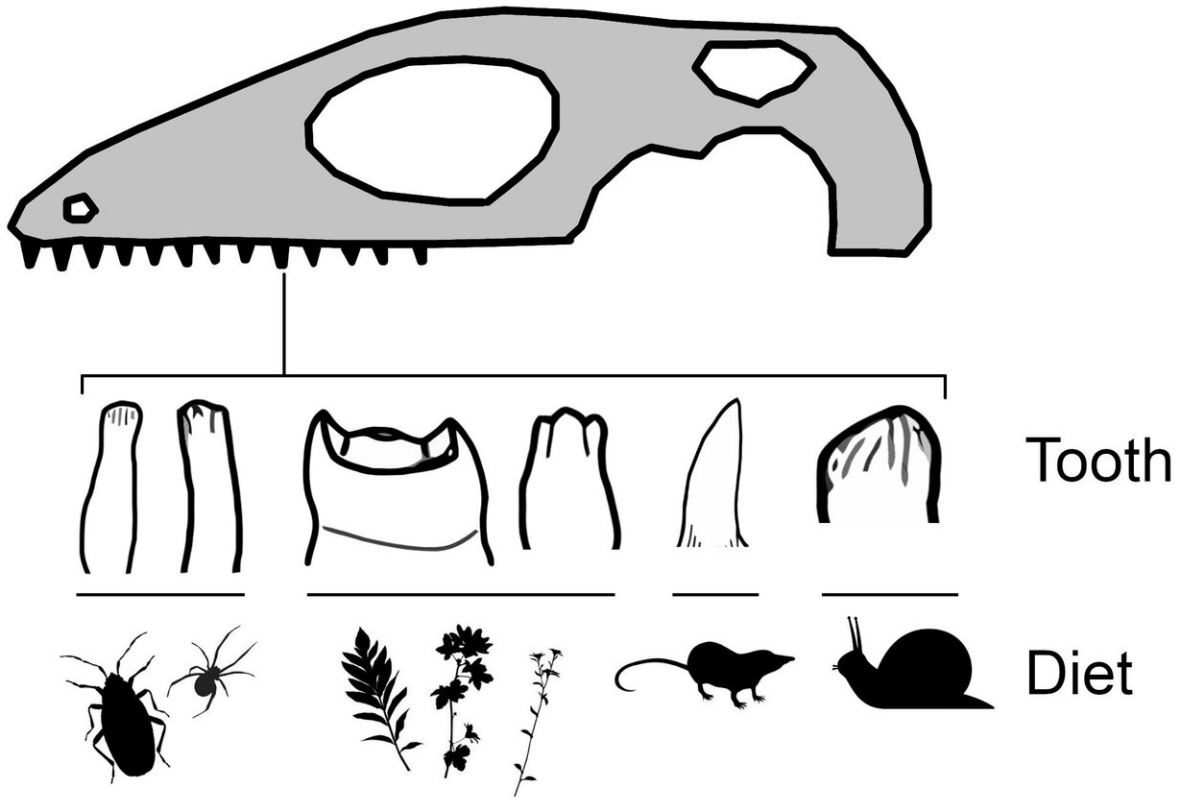
Cutting-edge analysis of prehistoric teeth sheds new light on the diets of lizards and snakes

March 2 2021



Modern and fossil lizards have many different tooth types. These are linked to different diets and can be used to assess dietary diversity through time in fossils. Credit: Tom Stubbs

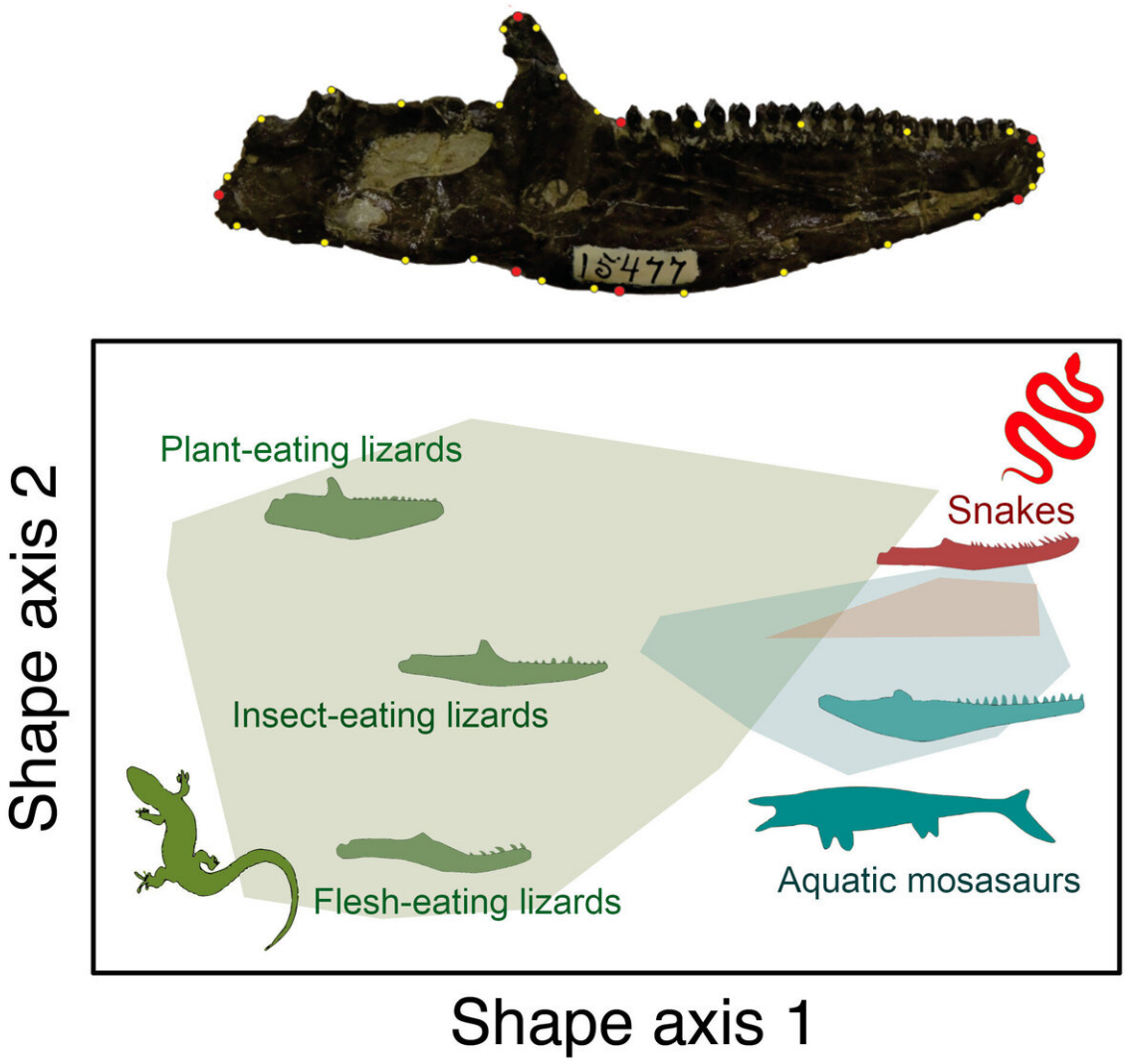
New research has revealed that the diets of early lizards and snakes, which lived alongside dinosaurs around 100 million years ago, were more varied and advanced than previously thought.

The study, led by the University of Bristol and published in *Royal Society Open Science*, showed lizards, snakes, and mosasaurs in the Cretaceous period already had the full spectrum of diet types, including flesh-eating and plant-based, which they have today.

There are currently some 10,000 species of lizards and snakes, known collectively as squamates. It was originally understood their great diversity was acquired only after the extinction of dinosaurs, but the findings demonstrate for the first time that squamates had modern levels of dietary specialisation 100 million years ago.

Fossils of lizards and snakes are quite rare in the Mesozoic, the age of dinosaurs and reptiles. This could simply be because their skeletons are small and delicate so hard to preserve, or it could show that lizards and snakes were in fact quite rare in the first half of their history.

The researchers studied 220 Mesozoic squamates, comprising lizards, snakes and mosasaurs, a group of extinct large marine reptiles. They measured their jaws and teeth and allocating them to dietary classes by comparison with modern forms. Some have long peg-like teeth and feed on insects, others have flat teeth used for chopping plant food. Predators have sharp, pointed teeth, and snakes have hooked teeth to grasp their prey.



Jaw shape variety can be visualised in 'morpho-spaces' and linked to diets. Credit: Tom Stubbs

All the fossil forms were allocated to one of eight feeding categories, and then their diversity through time was assessed. To the researchers' surprise, it turned out that the rather sparse Cretaceous squamates included examples of all modern feeding strategies.

"We don't know for sure how diverse squamates were in the Cretaceous," said lead author Dr. Jorge Herrera-Flores, who is now a Research Fellow at the National Autonomous University of Mexico.

"But we do know they had already achieved the full modern-type diversity of feeding modes by 100 million years ago, in the middle of the Cretaceous. Before that, squamates had already existed for more than 100 million years, but they seemed to be mainly insect-eaters up to that point."

"Studying teeth and jaws provides excellent insights into dietary and ecological variety," said co-author Dr. Tom Stubbs, Senior Research Associate at the University of Bristol School of Earth Sciences. "Fossil teeth and jaws give us the best insight into squamate evolution in the past. It would be easy to read the fossil record wrongly because of incomplete preservation. However, more fossil finds could only increase the number of feeding modes we identify in the Cretaceous, not reduce them."

Image of lizard fossil. Credit: Jorge Herrera Flores

The explanation for this early rush of dietary experimentation may be related to diversification in other areas. For instance, at this point in the Cretaceous, flowering plants had just begun to flourish and were already transforming ecosystems on land, while squamates also prevailed in the oceans.

"The Cretaceous Terrestrial Revolution made forests more complex," said co-author Professor Michael Benton, Professor of Vertebrate Palaeontology at the School of Earth Sciences. "The new flowering plants provided opportunities for insects and other creepy crawlies to feed on leaves, pollen and nectar, and to hide in the canopy. It's likely this burst of diversity gave a stimulus to mammals, birds and squamates, all of which diversified about this time, probably feeding on the insects,

spiders and other bugs, as well as on the new plant food."

The new work does not provide the single reason why squamates are so diverse today—nearly as diverse as birds. However, it shows that their ancestors had already explored all the likely feeding niches 100 million years ago before the dinosaurs died out.

More information: Ecomorphological diversification of squamates in the Cretaceous, *Royal Society Open Science* (2021). royalsocietypublishing.org/doi/10.1098/rsos.201961

Provided by University of Bristol