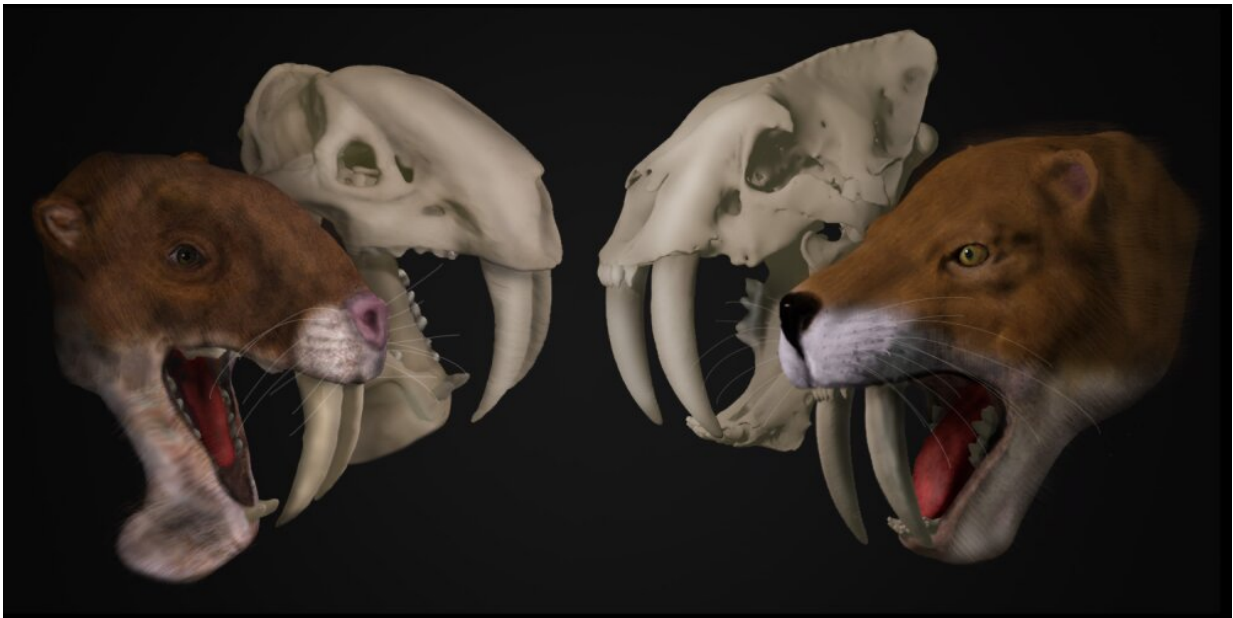


Bizarre saber-tooth predator from South America was no saber-tooth cat

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Skulls and life reconstructions of the marsupial saber-tooth *Thylacosmilus atrox* (left) and the saber-tooth cat *Smilodon fatalis* (right). Credit: Stephan Lautenschlager

A new study led by researchers from the University of Bristol has shown that not all saber-tooths were fearsome predators.

Saber-tooth cats, such as the North American species *Smilodon fatalis*, are among the most iconic fossil [animals](#) with a reputation for being

fierce predators. However, saber-tooths came in all shapes and sizes and nearly a hundred different saber-tooths are known to science so far.

Thylacosmilus atrox (which means 'terrible pouched knife') is a well-known animal that lived around five million years ago in Argentina.

A jaguar-sized marsupial, it is popularly known as the 'marsupial saber-tooth', compared with the sabertoothed cats elsewhere in the world, and it is often presented as a classic case of convergent evolution—where animals appear similar in form despite having very different evolutionary relationships (such as marsupial flying possums and placental flying squirrels—both of course being gliders rather than true fliers).

Thylacosmilus had huge, ever-growing canines, leading people to speculate that it was an even more vicious predator than the placental carnivores it superficially resembled such as *Smilodon*.

But was it really a fierce predator like the extinct placental saber-toothed cats, which seem to have been much like modern cats but with a different mode of killing their prey?

An international team of researchers, led by Professor Christine Janis from Bristol's School of Earth Sciences, have performed a series of studies on the skull and teeth of this animal and have come to a different conclusion. Their findings are published in the journal *PeerJ*.

Professor Janis said: "The title of this paper, 'An Eye for a Tooth', sums up how we think this animal has been perceived.

"It has impressive canines, for sure: but if you look at the whole picture of its anatomy, lots of things simply don't add up. For example, it just about lacks incisors, which big cats today use to get meat off the bone,

and its lower jaws were not fused together.

"In addition, the canines of *Thylacosmilus* were different from the teeth of other saber-toothed mammals, being triangular in shape like a claw rather than flat like a blade."

A statistical study, comparing aspects of the skull and teeth of *Thylacosmilus* with both present-day big cats and a diversity of extinct saber-toothed cats, confirmed suspicions about the differences from its placental supposed counterparts.

Co-author Borja Figueirido of the University of Málaga (Spain) added: "The skull superficially looks rather like that of a saber-toothed placental.

"But if you actually quantify things, it becomes clear that *Thylacosmilus*' skull was different in many details from any known carnivorous mammal, past or present."

Detailed biomechanical studies comparing the skulls of *Thylacosmilus* and *Smilodon*, simulating performance under different conditions, were also revealing.

Stephan Lautenschlager from the University of Birmingham, the contributing author on the paper who performed these analyses, said: "Previous studies by other researchers have shown *Thylacosmilus* to have had a weaker bite than *Smilodon*.

"But what we can show is there was probably a difference in behavior between the two species: *Thylacosmilus*' skull and canines are weaker in a stabbing action than those of *Smilodon*, but are stronger in a 'pull-back' type of action. This suggests that *Thylacosmilus* was not using its canines to kill with, but perhaps instead to open carcasses."

Finally, the other teeth of *Thylacosmilus* also pose problems for the interpretation of this animal as a cat-like predator, whether saber-toothed or not. Besides the puzzling lack of incisors, the molars are small, and did not wear down along the sides as seen in an animal feeding on meat.

Larisa DeSantis from Vanderbilt University (USA), who conducted a detailed dental study, added: "The molars tend to wear flat from the top, rather like you see in a bone crusher.

"But if you examine the detailed microwear on tooth surfaces, it's clear that it was eating soft food. Its wear is most similar to that of cheetahs which eat from fresh carcasses and suggests an even softer diet than fed to captive lions.

"*Thylacosmilus* was not a bone-crusher and may have instead specialized on internal organs."

Professor Janis said: "It's a bit of a mystery as to what this animal was actually doing but it's clear that it wasn't just a marsupial version of a saber-toothed cat like *Smilodon*.

"In addition to the differences in the skull and the teeth, it was also short-legged and stiff-backed, and lacked retractile claws, so it would have had difficulties in pursuing its prey, pouncing on it and holding on to it. I suspect it was some sort of specialized scavenger.

"It may have employed those canines to open carcasses and perhaps also used a big tongue to help extract the innards: other mammals that have lost the incisors, like walruses and anteaters, also have big tongues that they use in feeding."

When *Thylacosmilus* lived on the plains of Argentina five million years ago, it would have inhabited a very different type of ecosystem to any

modern one. Then the big predators were huge flightless birds, the "terror birds" or phorusrachiformes, now all extinct. Life in the past may have been very different to the present day.

Borja Figueirido added: "In Africa today it's the mammals who are the killers and the big birds, like vultures, are the scavengers. But perhaps five million years ago in Argentina it was the other way around, and it was the mammals who were the scavengers."

More information: An eye for a tooth: Thylacosmilus was not a marsupial saber-tooth predator, by Christine M. Janis et al., *PeerJ* (2020).

Provided by University of Bristol

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