'Steak-knife' teeth reveal ecology of oldest land predators

February 7 2014

This is an artist impression of a *Dimetrodon*. Credit: Danielle Dufault

The first top predators to walk on land were not afraid to bite off more than they could chew, a University of Toronto Mississauga study has

found.

Graduate student and lead author Kirstin Brink along with Professor Robert Reisz from U of T Mississauga's Department of Biology suggest that *Dimetrodon*, a carnivore that walked on land between 298 million and 272 million years ago, was the first terrestrial vertebrate to develop serrated ziphodont teeth.

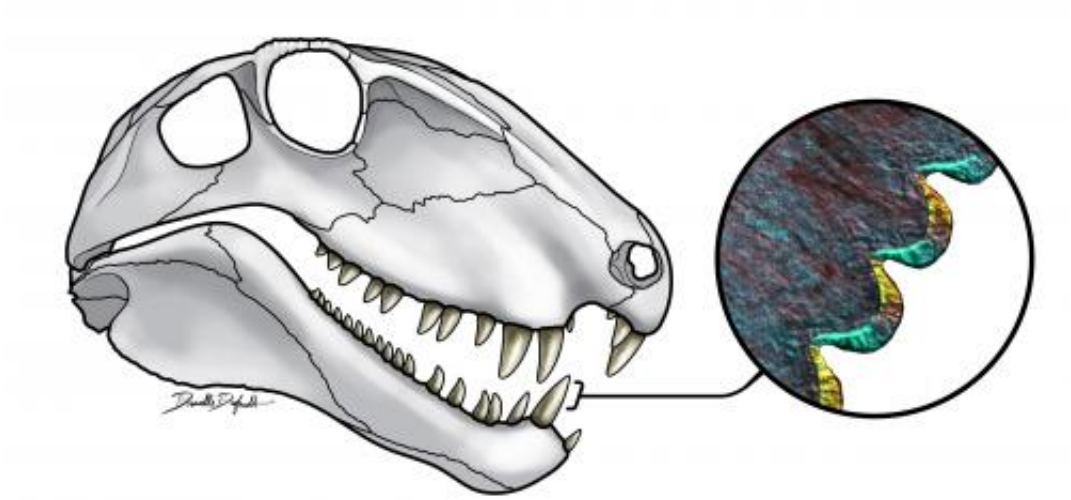
According to the study published in *Nature Communications*, ziphodont teeth, with their serrated edges, produced a more-efficient bite and would have allowed *Dimetrodon* to eat prey much larger than itself.

While most meat-eating dinosaurs possessed ziphodont teeth, fossil evidence suggests serrated teeth first evolved in *Dimetrodon* some 40 million years earlier than theropod dinosaurs.

"Technologies such as scanning electron microscope (SEM) and histology allowed us to examine these teeth in detail to reveal previously unknown patterns in the evolutionary history of *Dimetrodon*," Brink said.

The four-meter-long *Dimetrodon* was the top of the terrestrial food chain in the Early Permian Period and is considered to be the forerunner of mammals.

According to Brink and Reisz's research, *Dimetrodon* had a diversity of previously unknown tooth structures and were also the first terrestrial vertebrate to develop cusps – teeth with raised points on the crown, which are dominant in mammals.



This is a *Dimetrodon* skull with histological thin section tooth detail by Danielle Dufault. Credit: Danielle Dufault

The study also suggests ziphodont teeth were confined to later species of *Dimetrodon*, indicating a gradual change in feeding habits.

"This research is an important step in reconstructing the structure of ancient complex communities," Reisz said.

"Teeth tell us a lot more about the ecology of animals than just looking at the skeleton."

"We already know from fossil evidence which animals existed at that time but now with this type of research we are starting to piece together how the members of these communities interacted."

Kirstin Brink and Robert Reisz are shown with a *Dimetrodon* skull. Credit: University of Toronto Mississauga

Brink and Reisz studied the changes in *Dimetrodon* teeth across 25 million years of evolution.

The analysis indicated the changes in tooth structure occurred in the absence of any significant evolution in skull morphology. This, Brink and Reisz suggest, indicates a change in feeding style and trophic interactions.

"The steak knife configuration of these teeth and the architecture of the skull suggest *Dimetrodon* was able to grab and rip and dismember large prey," Reisz said.

"Teeth fossils have attracted a lot of attention in dinosaurs but much less is known about the animals that lived during this first chapter in

terrestrial evolution."

Provided by University of Toronto