# Taking the temperature of a dinosaur

August 24 2010, By Mary Caperton Morton

A couple of T-rex skulls with the teeth on full display. Credit: Mary Caperton Morton

Tyrannosaurus rex is often portrayed as a cold-blooded killer, but whether the Cretaceous-era dinosaur actually had a slow, reptilian-like metabolism or a faster, more bird-like metabolism is still a mystery.

Now a new technique using rare isotopes preserved in tooth enamel is proving to be a reliable way of determining body temperatures of recently extinct animals like woolly mammoths and researchers are hoping the method will work on even older fossils, including dinosaurs.

A team of researchers led by Robert Eagle, a biologist at the California Institute of Technology in Pasadena, California, found that rare, heavy isotopes of carbon-13 and oxygen-18 clump together differently depending on temperature.

"It's basic thermodynamics: At warmer temperatures, you get a more random distribution of these isotopes with less clumping," Eagle said. "As temperature decreases things slow down and you begin to see more bonding."

When this bonding takes place within an organism, such as in the formation of the mineral apatite to form tooth enamel, the pattern of bonds preserves a record of the animal's body temperature, within a few degrees.

To test the new technique, Eagle and colleagues began by experimenting with teeth from modern animals like the white rhinoceros, Indian elephant, Nile crocodile and sand tiger shark. The temperatures produced using the isotope technique matched the known body temperatures for all four species within 1 degree Celsius.

The team then turned their attention to 20,000 year old woolly mammoth teeth and 12 million year old alligator and rhino teeth with similar success, as they reported in the Proceedings of the National Academy of Sciences in May.

Since this is the first method for directly measuring the body temperatures of extinct vertebrates, Eagle and colleagues compared the temperature data for mammoths, alligators and rhinos with their modern counterparts, which are thought to have very similar metabolisms to their ancient relatives.

"This study was really a proof of concept," Eagle said. "The really exciting applications are the ones that are around the corner, as we go even further back in time."

Based on other lines of evidence, such as growth rates, Kevin Padian, an evolutionary biologist at the University of California, Berkeley, who was not involved in the new study, said it's likely that some species of dinosaurs had a high metabolic rate and were able to control their own body temperatures, much like mammals and birds today.

"I think we already understand a lot about their metabolism, but we don't have a lot of hard evidence," Padian said. "This new study could provide an entirely new line of evidence, which is great."

But while determining relative body temperatures will certainly be helpful, evolutionary biologist Padian said that the findings won't completely solve the dinosaurs' metabolic mystery.

Whether dinosaurs were homeothermic and maintained one consistent body temperature like many species of mammals or were heterothermic and could adjust their body temperatures, like birds, cannot be answered by the isotopic technique, he said.

Eagle and colleagues plan to continue using their isotopic method to test progressively older fossils, including species of dinosaurs and early mammals.

"So far we've seen that tooth enamel is very hard material that is quite resistant to chemical change over long time scales," Eagle said.

If the technique proves successful on older fossils, Padian hopes it will be also be applied to a wide variety of dinosaurs and early mammals from different latitudes and at varying stages of evolutionary development.

"They could paint a very interesting picture using this technique," Padian said. "The more things you try the more insight you get. That's how science works."

Provided by Inside Science News Service

Citation: Taking the temperature of a dinosaur (2010, August 24) retrieved 5 February 2026 from https://phys.org/news/2010-08-temperature-dinosaur.html