Science News Online

Week of Sept. 9, 2000; Vol. 158, No. 11

Teeth tell tale of warm-blooded dinosaurs

Sid Perkins

Veterinarians have long used a horse's teeth as an indicator of the animal's health and wellbeing. Now, two scientists say that evidence locked within the fossil teeth of some dinosaurs may help bolster the hotly contested view that some of the animals were, at least to some degree, warm-blooded.

Tooth enamel and bone are made of a dense phosphate mineral called apatite. The oxygen atoms in apatite don't tend to swap out with others during fossilization, even after millions of years. Therefore, the phosphate can be a good indicator of the environmental conditions–both inside and outside the animal–under which fossil teeth and bones formed, says Henry C. Fricke, a chemist at Colorado College in Colorado Springs.

For example, the ratio of two oxygen isotopes–oxygen-18 and oxygen-16–found in precipitation, rivers, and lakes varies with latitude due to differences in mean annual temperature.

This variation then shows up in the bloodstream of animals that drink the water and ultimately in the phosphate in the animals' growing teeth, Fricke says.

The ratio of the concentrations of these two oxygen isotopes in teeth also depends upon the body temperature of the animal, adds Fricke.

In the September *Geology*, he and Raymond R. Rogers of Macalester College in St. Paul, Minn., report measurements of the ratio of oxygen-18 to oxygen-16 in small fossil teeth of three different types of theropod dinosaurs collected from sites between Madagascar and Alaska. The researchers compared these data with those obtained from fossil crocodile teeth found at the same locations or at similar latitudes. All the fossil teeth studied were about 75 million years old.

Fricke and Rogers report that the isotope ratio in the crocodile teeth varied differently across latitudes than did the ratio in the theropod teeth. This, Fricke contends, is evidence that the two types of animals had different styles of regulating body temperature. It suggests that, unlike crocodiles, the theropods had a constant body temperature regardless of external conditions. In other words, he says, the theropods were at least partially warm-blooded.

Reese E. Barrick, a paleobiologist at North Carolina State University in Raleigh, contends that several assumptions in Fricke's analysis may be too broad.

Although all of the fossils came from the same geological formations, Barrick says, each one of those formations represents a period of up to 6 million years. In that expanse of time, climate–and therefore the precipitation's oxygen-isotope ratios–can change considerably.

Also, Barrick says that small teeth, such as those used in the study, might have grown only during a single portion of the year and therefore may not fully reflect the mean annual temperature at the latitude where the animal lived.

Other factors, such as feeding behavior, also could have affected the oxygen-isotope ratio in the fossil teeth, Barrick says. The ratio could vary somewhat, for example, depending on how much of the water in an animal's body came from the blood of its prey rather than from the water the animal drank.

Matthew J. Kohn, a geochemist at the University of South Carolina in Columbia, supports Fricke's analysis.

Even though crocodiles don't have metabolic control over their body temperatures like mammals and birds do, Kohn says, these reptiles can turn to behaviors to maintain relatively constant body temperature. They bask in the sun to absorb heat and take a dip to cool off, he notes.

"Although we don't know much about crocodile behavior 75 million years ago, theropod behavior would really have to have been fine-tuned for them to maintain a more constant body temperature than modern crocodiles can," Kohn says. "This suggests that there was at least some degree of metabolic control of body temperature in theropods."