Teeth offer a taste of ancient lifestyles

Teeth can't talk, but they can tell a visual tale about how the dinosaurs and other ancient animals lived, say paleontologists who have devised two ways to study long-extinct creatures by probing their dental details.

By looking inside fossilized reptile teeth, one scientist has developed a process that may help in estimating dinosaur populations. Another researcher has examined the outside of mammal teeth to help decipher the eating habits of ancestral primates. The two described their work last week in separate talks at the annual meeting of the Society of Vertebrate Paleontology, held in San Diego.

Gregory M. Erickson of the Museum of the Rockies in Bozeman, Mont., studied dental growth lines visible inside the fossilized teeth of dinosaurs. Using living alligators as an analog, he demonstrated that each line in the fossil tooth corresponds to one day of growth – enabling researchers to determine how long it took different dinosaurs to develop their teeth.

To make his case, Erickson injected tooth-staining tetracycline into live alligators, which were raised at a commercial farm and later killed for their skins. Examining a cross section of each tooth under a scanning electron microscope, he then located the tetracycline stain and counted the growth rings that had developed since the injection. The number of rings matched the number of days between injection and slaughter, proving the teeth grew a ring each day. Because dental rings in fossil alligators and dinosaurs resemble those in live reptiles, Erickson reasoned that the rings inside dinosaur teeth also represent daily growth.

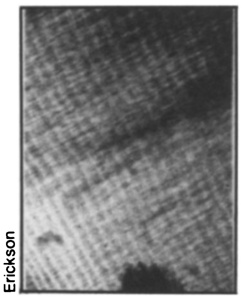
Such information can reveal how often a dinosaur shed its teeth, he says. Erickson found that plant-eating hadrosaurs went through their teeth rapidly, replacing each after two to three months, whereas the knife-like teeth of the carnivorous *Tyrannosaurus rex* lasted 2½ to three years before falling out.

Paleontologist Kevin Padian of the University of California, Berkeley, praises Erickson's study for combining several analytical techniques that are making their way into studies of ancient animals.

Teeth, as the hardest part of the body, resist erosion and fossilize much more readily than bone. In the past, experts have tried to estimate dinosaur populations from the numbers of various teeth found at particular sites. But many scientists rejected those studies, in part because investigators had no means of calculating how often the animals replaced old teeth with new ones. Erickson believes paleontologists can now use growth lines to address population questions such as the number of adult dinosaurs versus young ones or the number of predators versus prey.

In separate work, Suzanne G. Strait of Duke University in Durham, N.C., studied microscopic abrasions on tooth enamel to deduce the dining preferences of ancient animals. Other anthropologists and paleontologists have used this technique, but Strait is the first to apply it to small "faunivorous" mammals, which eat insects and/or vertebrates.

Examining living primates and bats, she showed that a diet of hard objects, such as beetles or bone, produces a different pattern of enamel scratches than does a diet of soft objects, such as moths or meat. She then used microscratch patterns and the general tooth shape to infer that a group of early primates primarily ate hard insects.



Erickson

Micrograph shows growth lines inside a fossilized dinosaur tooth.

Erickson and Strait will share the Romer Prize, awarded for the best student paper presented at last week's meeting. John J. Flynn of the Field Museum in Chicago says their work "has potential application to a wide variety of [animal] groups." *– R. Monastersky*

Summer ozone loss detected for first time

A United Nations scientific panel announced last week that over the last two decades, the global ozone layer has thinned significantly during the spring and summer seasons, when people face the greatest danger from the sun's ultraviolet rays.

The panel also reported the unexpected finding that ozone thinning has occurred in the lower stratosphere. "This is a bit new. We had anticipated that the losses would be in the *upper* stratosphere," says panel co-chairman Daniel Albritton, an atmospheric scientist with the National Oceanic and Atmospheric Administration in Boulder, Colo. The new finding suggests that scientists need to reduce their estimates of future global warming from greenhouse gases.

The United Nations team made these discoveries while assessing the latest data on stratospheric ozone levels and ozone-destroying chemical pollutants. Government leaders will use the new findings when they meet next year to consider strengthening the Montreal Protocol, an international treaty adopted in 1988 to reduce certain chemicals that erode the ozone layer. Signatory nations made the treaty more stringent last year by agreeing to ban all chlorofluorocarbons (CFCs) and halons by the end of this century.

The panel's review of ground-based measurements indicates that ozone levels have been decreasing everywhere except over the tropics. Over the northern midlatitudes – a region that includes the contiguous United States and most of Canada – spring and summertime ozone levels have fallen by 3.3 ± 1.2 percent per decade since 1979.

This is the first time instruments have detected summertime ozone decreases over the midlatitudes. Ozone depletions are particularly dangerous during summer because ultraviolet radiation, which causes skin cancer, reaches its peak and people spend more time outdoors in that season.

Scientists think chlorine pollution is driving the long-term erosion of the global ozone layer, Albritton says. Previous work has confirmed that these chemicals cause the Antarctic ozone hole and ozone losses in the Arctic.

After the United Nations released its report, Du Pont, the world's largest producer of CFCs, announced it would phase out CFCs by the end of 1996 and halons by the end of 1994.

Sensors on balloons, satellites and ground stations all indicate that the global ozone decreases have occurred in the lower stratosphere, below about 25 kilometers in altitude, according to the report. Because of the way ozone molecules absorb and emit energy, ozone thinning high in the stratosphere would contribute to global warming. But theory suggests that losses in the lower stratosphere should cool the climate – in a sense canceling out part of the warming effect from greenhouse gases. Indeed, temperature records indicate that the lower stratosphere has cooled slightly over the last two decades, the panel noted in its report.

None of the sophisticated climate models used to predict global warming has taken into account the lower-stratosphere ozone loss, says James Hansen, a climate modeler at NASA's Goddard Institute for Space Studies in New York City. "It's fair to say that if it is indeed confirmed that the ozone changes cause a cooling, then most of the simulations somewhat overestimate the expected greenhouse warming," he told Science News.

Including the new information on ozone loss may lower predictions of global temperature increases by about 20 percent, Hansen speculates. "It's not a tremendous change, but it's significant," he says. *– R. Monastersky*