SCIENCE NEWS of the week

New Bite to Fossil Analysis?

Evidence suggesting that early ancestors of modern humans grew in a distinctively nonhuman way—characterized by a short period of intensive growth much like that observed in modern great apes—has come, literally, from the mouths of babes. When examined with an electron scanning microscope, the tooth enamel of 3.5-million- to 1.5-million-year-old infants also indicates that they were significantly younger at the time of their deaths than has previously been estimated, say anthropologist Timothy G. Bromage and anatomist C. Christopher Dean of University College in London, England.

Other scientists are also finding signs that human ancestors who lived over 1.5 million years ago were more apelike than humanlike, notes Bromage, "but there has not been a means of demonstrating growth and developmental stages directly until now."

However, some researchers involved in the study of human origins, an endeavor that often provokes heated debate, contend that too little is known about growth patterns in the enamel of modern humans and apes to make comparisons with fossil teeth.

Bromage and Dean compared electron microscope data for 10 unworn teeth from modern-day youngsters with dental impressions of nine fossil teeth from Africa. The fossils include teeth from the *Australopithecines*, the earliest known humanlike creatures, and early *Homo*, a precursor of modern *Homo sapiens*. The researchers estimated the fossils' ages at the time of death by counting the coarse lines separating enamel layers on the tooth surface. Studies of teeth from modern humans and other mammals indicate, they say, that each layer of enamel forms over an average of seven to eight days. Youngsters' teeth must be analyzed, the researchers explain, because the lines separating enamel layers wear off with age.

Their calculations show that the creatures represented by the fossil teeth were markedly younger than previous estimates of 4½ to 7 years old, based on tooth eruption, maturation and wear. Revised ages range from about 3 to 5 years old at the time of death. Furthermore, growth occurs over a shorter time span in the fossil teeth than in modern human teeth, report the investigators in the Oct. 10 NATURE; fossil tooth growth is similar to that observed in modern great apes.

"What appears to be going on is mosaic evolution," Bromage observes. "*Australopithecines* walked on two legs and early *Homo* had a slightly larger cranial capacity, but this didn't necessarily correlate with prolonged growth and development. But I'd bet *Homo erectus* [which appeared about 1.5 million years ago and had a much larger brain than its predecessors] will show longer, more modern growth periods in its enamel." The teeth of young *Homo erectus* individuals are hard to come by, says Bromage, but preliminary data from *Neanderthals*, which lived around 125,000 years ago, indicate that their enamel growth was similar to that of modern humans.

Also hard to come by is consensus on the value of analyzing enamel. "This is not a new idea," says anthropologist Alan Mann of the University of Pennsylvania in Philadelphia, "but there is a lot of evidence that enamel formation is too variable [between individuals] to be of any use in estimating age." Mann has analyzed early human fossil teeth along more traditional lines and concludes that signs of growth are more humanlike than apelike.

Adds anthropologist Fred Grine of the State University of New York at Stony Brook, "There is no good evidence that enamel layers are formed on a daily basis and no solid evidence [on enamel formation] from modern populations of humans and apes to compare to fossils."

Alan Boyde, a pioneer of enamel analysis with electron scanning microscopes, says his studies of modern human teeth support Bromage and Dean's findings. "Their data is unquestionably better than anything that has gone before," says Boyde, also of University College. "They can't be far wrong."

—B. Bower

Crowning a rookie chess champion

The heavy burden of high expectations lay over the rookie Hitech when it made its first move last week at the North American computer chess championship. Three days and four matches later, Hitech was the undisputed title holder. Left far behind was the reigning world champion CRAY BLITZ (SN: 10/29/83, p. 276). Raw speed was no longer enough.

Newcomer Hitech was created by Hans Berliner, a former world chess-by-mail champion, and a crew of assorted experts at Carnegie-Mellon University in Pittsburgh. In this custom-built chess machine, an "oracle," running on a Sun minicomputer, encodes chess knowledge while a specially designed "searcher" does the work.

Before the start of a search for the best move, the oracle analyzes a chess position and decides what information the search must uncover. Then each one of the searcher's 64 integrated-circuit chips is loaded with its assignment. Each chip, working in parallel, comes up with its own idea for the best move and passes a numeric score back to the oracle, which acts as an arbitrator.

"We have a faster move generator than anybody has ever had," says Berliner. "But we also have some idea of the 'goodness' of the moves as they come off the production line." The system is organized so that increasing the computer's chess knowledge doesn't lengthen search times. Hitech's knowledge base can be expanded indefinitely.

This design overcomes a major constraint often faced by programs like CRAY BLITZ, which run on supercomputers. A computer without Hitech's special architecture has to choose between taking a cursory look at millions of positions or a more careful, informed look at fewer positions.

The same feature may also have practical value. Berliner is exploring the possibility of using a similar architecture for determining molecular structures. Given a substance's chemical properties and the number of atoms of each type present, the computer would try various combinations and score them, says Berliner, "just like you score chess positions."

Hitech played its first game last May. Since then, it has progressed rapidly. In a tune-up tournament a week before the championship, Hitech played three human chess masters, winning two games and drawing one. It won the tournament and achieved a performance rating of 2530. This puts Hitech within striking distance of a grandmaster rating. World champion Anatoly Karpov is rated at 2705.

Ten chess machines and computer programs vied for the title at last week's championship in Denver. Although some longtime competitors and former champions like Belle and NUCHESS were missing, others saw this tournament as an important warm-up for the world championship next June in Cologne, West Germany.

The results were encouraging for custom-built chess machines. Another such machine, BEBE (SN: 11/5/83, p. 303), placed second, while CRAY BLITZ won only two of four games to end up tied for fourth place. One surprise was Intelligent Software, a program running on an Apple computer, which placed third.

"Basically, it's a tough league," says tournament organizer Monroe Newborn of McGill University in Montreal. "The competition is fierce. People are working very hard. The work is paying off."

—I. Peterson