Ancient human ancestor Australopithecus sediba had unique diet: study

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A high-tech dental analysis of a 2-million-year-old hominid from South Africa involving CU-Boulder researchers indicates it had a unique diet that included trees, bushes and fruits. Credit: Paul Sandberg, University of Colorado

When it came to eating, an upright, 2-million-year-old African hominid had a diet unlike virtually all other known human ancestors, says a study led by the Max Planck Institute of Evolutionary Anthropology in Leipzig, Germany and involving the University of Colorado Boulder.

The study indicated that Australopithecus *sediba* -- a short, gangly hominid that lived in South Africa -- ate harder foods than other early hominids, targeting trees, bushes and fruits. In contrast, virtually all other ancient human ancestors tested from Africa -- including *Paranthropus boisei*, dubbed "Nutcracker Man" because of its massive jaws and teeth -- focused more on grasses and sedges, said CU-Boulder doctoral student

Paul Sandberg, a co-author on the new study.

The *A. sediba* diet was analyzed using a technique that involved zapping fossilized teeth with a laser, said Sandberg. The laser frees telltale carbon from the enamel of teeth, allowing scientists to pinpoint the types of plants that were consumed and the environments in which the hominids lived. The carbon signals from the teeth are split into two groups: C3 plants like trees, shrubs and bushes preferred by *A. sediba*, and C4 plants like grasses and sedges consumed by many other early hominids.

The teeth from the two *A. sediba* individuals analyzed in the study had carbon isotope values outside the range of all 81 previously tested hominids. "The lack of any C4 evidence, and the evidence for the consumption of hard objects, are what make the inferred diet of these individuals compelling," said Sandberg.

"It is an important finding because diet is one of the fundamental aspects of an animal, one that drives its behavior and ecological niche. As environments change over time because of shifting climates, animals are generally forced to either move or to adapt to their new surroundings," said Sandberg of CU-Boulder's anthropology department.

The researchers concluded from their scientific tests that bark and other fracture-resistant foods were at least a seasonal part of the *A. sediba* diet. While bark and woody tissues had not been previously documented as a dietary component of any other ancient African hominids, such foods are consumed by many contemporary primates and contain both protein and soluble sugars. The diet of *A. sediba* may have been similar to that of today's African savanna chimpanzees, Sandberg said.

One unique aspect of the project was the analysis of microscopic, fossilized particles of plant tissue known as phytoliths trapped in ancient tooth tarter, a hardened form of dental plaque, said corresponding study

author Amanda Henry of the Max Planck Institute for Evolutionary Anthropology.

"The fact that these phytoliths are preserved in the teeth of 2-million-year-old hominids is remarkable and speaks to the amazing preservation at the site," said Sandberg. "The phytolith data suggest the *A. sediba* individuals were avoiding the grasses growing in open grasslands that were abundant in the region at the time."

A third, independent line of study -- analyzing microscopic pits and scratches on *A. sediba* teeth, which reveal what they were eating at the time just prior to death -- also confirmed that at least one of the hominids was eating harder foods, said Sandberg.

A paper on the subject was published online by *Nature* on June 27. Other paper authors included Professor Matt Sponheimer of CU-Boulder, Peter Ungar of the University of Arkansas, Benjamin Passey of Johns Hopkins University, Lloyd Rossouw of the Bloemfontein National Museum in Bloemfontein, South Africa, Lee Berger and Marion Bamford of the University of Witwatersrand in Johannesburg, South Africa and Darryl de Ruiter of Texas A&M University.

A. sediba is particularly intriguing to anthropologists. The first two individuals discovered -- a juvenile male and an adult female from the Malapa Cave site roughly 30 miles north of Johannesburg in 2008 --apparently had fallen into a hidden pit in the cave and died. With an upright posture and long arms, the curious creature appears to have characteristics of both primitive and modern hominids, including a human-like ankle, short fingers and a long thumb for possible precision gripping and a relatively complex brain compared to earlier hominids, according to researchers.

The jury is still out on exactly where these hominids land on the family

tree. *A. sediba* may have been a descendant of *A. africanus*, which was spawned by *A. afarensis*, a hominid represented by "Lucy" who lived about 3 million years ago and is considered by many to be the matriarch of the human family.

The *A. sediba* remains at Malapa were dated to 2 million years by scientists, a precise number obtained by measuring the decay of isotopes of uranium into lead that occurred in a type of mineral deposit known as flowstone that capped the fossil-bearing layer.

Paleontological evidence, including pollen and phytoliths, shows that the region around Malapa likely was a mix of abundant grassland and woody vegetation about 2 million years ago, said Sandberg. The team's carbon isotope research on the ancient teeth of rodents and hooved mammals that inhabited the region at the time indicated they had a strong affinity for C4 grasses and sedges.

"What fascinates me is that these individuals are oddballs," said CU-Boulder's Sponheimer. "I had pretty much convinced myself that after 4 million years ago most of our hominid kin had diets that were different from living apes, but now I am not so sure. And while our sample is too small to be conclusive, the rate at which Malapa is spewing hominid fossils makes me reasonably certain we won't have to wait another 2 million years to augment our data set. "

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Provided by University of Colorado at Boulder

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