Researchers Link Tooth Chipping in Fossils With Diets of Early Humans

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(PhysOrg.com) -- George Washington University researchers have discovered a new method of linking tooth chips in fossils of early humans with their eating habits. Based on chip and tooth size, the research of anthropologists Paul Constantino and Peter Lucas suggests that early humans consumed large, hard foods such as seeds and nuts and occasionally used high bite forces to do so. Together with researchers from the National Institute of Standards and Technology, Drs. Constantino and Lucas examined modern human teeth to help link chip characteristics to the diet and eating behavior of early humans as well as great apes, monkeys and forest pigs.

“While it has long been suggested that tooth chipping could reveal information about diet, there has been little agreement as to what exactly it could tell us,” said Dr. Constantino. “We used a fracture mechanics approach to show that chipping is solely the result of contact with large, hard objects and that a simple measure of chip size can give a reasonably accurate estimate of the bite force that was used when that chip was created."

Many early humans had large teeth and jaws. In some cases, the back teeth of these fossils were three-to-four times the size of modern human teeth with enamel that was twice as thick. Until now, scientists have not been able to explain why. The research of Drs. Constantino and Lucas suggests that early humans used high bite forces to eat large, hard foods like seeds and nuts and the need to eat such foods may be a reason for their large jaws and large, thickly-enameled teeth.

By taking a very simple measure of the size of a chip on a fossil tooth, the researchers were able to determine the bite force the animal used when the chip was made. The researchers also found that tooth size correlates with previous estimates of maximum possible bite force, allowing scientists to now determine the greatest force at which an animal could bite and decipher the range of foods that the animal could have possibly eaten.

This new method of detecting dietary habits and bite force is especially useful because it only requires a single tooth with a well-defined chip from the species. Previous methods of measuring bite force from fossils have been based on analyses of jaw mechanics and require a nearly complete skull. Now paleontologists can apply the new method to estimate bite forces for a whole range of fossil species for which it was previously impossible, including almost any toothed vertebrate that occasionally ate hard foods.

Dr. Constantino is a postdoctoral researcher in the Department of Anthropology at The George Washington University. As a biological anthropologist and evolutionary morphologist, Dr. Constantino studies the evolution of skull morphology in mammals, especially hominins. His previous research has been published in other scientific journals including, American Journal of Physical Anthropology and Evolutionary Anthroplogy. Dr. Lucas is a professor of anthropology at GW and studies primate feeding ecology and feeding processes. GW student Charles Ziscovici also was a member of the research team.

The article, “Tooth chipping can reveal the diet and bite forces of fossil hominins,” will appear in the June 2, 2010, issue of the Royal Society Journal "*Biology Letters*."

Provided by George Washington University