Size isn't everything -- it's how sharp you are

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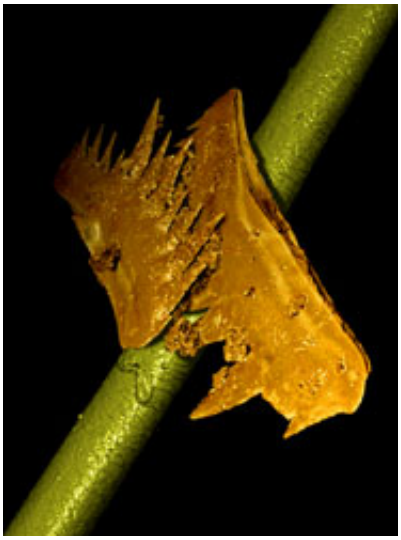

Three dimensional model of an articulated pair of conodont teeth and a human hair for scale, both created using synchrotron radiation x-ray computed micro-tomography. Image by D. Jones, A. R. Evans, K. K. W. Siu

(PhysOrg.com) -- The tiny teeth of a long-extinct vertebrate – with tips only two micrometres across: one twentieth the width of a human hair – are the sharpest dental structures ever measured, new research from the University of Bristol and Monash University, Australia has found.

For 300 million years, Earth's oceans teemed with conodonts – early vertebrates that kept their skeleton in their mouth. The elements of this skeleton look uncannily like teeth (see image) and, like teeth, they were often worn and broken during life. This evidence strongly suggests that

conodonts evolved the first vertebrate dentitions.

Scientists know that conodont elements worked differently from the teeth of other animals: they are microscopic – about 2 to 0.2 mm long – and must have had paltry muscles to move them, with no jaws to which they could attach. So how could they possibly have worked as teeth? In a new study published today in the *Proceedings of the Royal Society B* the Bristol and Monash University researchers answer this question.

Dr David Jones of Bristol's School of Earth Sciences, one of the study's authors, said: "The first problem is: how do you analyse such tiny teeth? The answer: with a very big machine. We created high resolution 3D models of the conodont elements using x-rays from a particle accelerator in Japan, using it like a giant CT scanner. These virtual models were examined, leaving the original specimens untouched."

The team discovered that conodont elements are the sharpest dental structures ever measured. This sharpness allowed conodonts to overcome the limitations of their small size: since pressure is simply force applied divided by area, to increase pressure you must either increase the force or shrink the area. Conodont evolution took the latter route, allowing them to apply enough pressure to break up their food.

The work places dental evolution in larger vertebrates, like humans, in perspective: they took the alternative route, developing less efficient but less breakable, blunter teeth, to which greater force can be applied by jaw muscles.

The results could also reveal the properties of the food conodonts could eat. Many conodont elements formed notched blades, similar to the cheek teeth of modern mammal carnivores like cats and dogs. In mammals, these bladed teeth are used to process tough foods like meat or insects. Conodonts would have been able to use their elements to deal

with similarly tough foods.

"So next time you're struggling through a tough Sunday roast, remember that conodonts evolved the tools for the job 500 million years ago," Dr Jones said.

More information: The paper, "The sharpest tools in the box? Quantitative analysis of conodont element functional morphology" by David Jones, Alistair R. Evans, Emily J. Rayfield, Karen K. W. Siu and Philip C. J. Donoghue is published online in *Proceedings of the Royal Society B*, available at rspb.royalsocietypublishing.or … .1098/rspb.2012.0147

Provided by University of Bristol