Beak evolution in some dinosaurs likely associated with diet, not flight, study shows

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Credit: Copyright: Dr. Stephan Lautenschlager

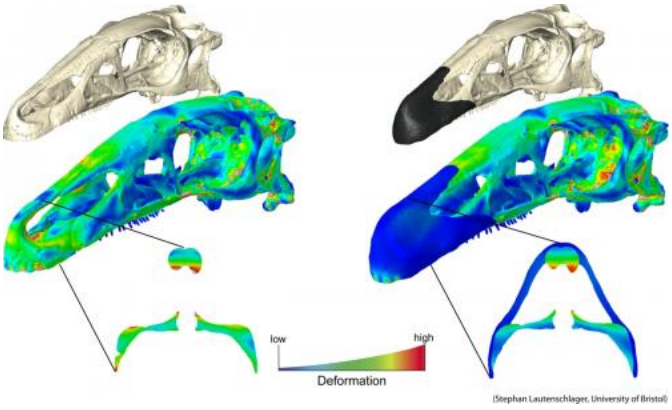
Beaks are a typical hallmark of modern birds and can be found in a huge variety of forms and shapes. However, it is less well known that keratin-covered beaks had already evolved in different groups of dinosaurs during the Cretaceous Period.

Employing high-resolution X-ray computed tomography (CT scanning) and computer simulations, Dr Stephan Lautenschlager and Dr Emily Rayfield of the University of Bristol with Dr Perle Altangerel (National University of Ulaanbaatar) and Professor Lawrence Witmer (Ohio University) used digital models to take a closer look at these dinosaur beaks.

The focus of the study was the skull of *Erlikosaurus andrewsi*, a 3-4m (10-13ft) large herbivorous dinosaur called a therizinosaur, which lived more than 90 million years ago during the Cretaceous Period in what is now Mongolia, and which shows evidence that part of its snout was covered by a keratinous beak.

This new study reveals that keratinous beaks played an important role in stabilizing the skeletal structure during feeding, making the skull less susceptible to bending and deformation.

Lead author Dr Stephan Lautenschlager of Bristol's School of Earth Sciences said: "It has classically been assumed that beaks evolved to replace teeth and thus save weight, as a requirement for the evolution of flight. Our results, however, indicate that keratin beaks were in fact beneficial to enhance the stability of the skull during biting and feeding."



Credit: Copyright: Dr. Stephan Lautenschlager

Co-author Dr Emily Rayfield, Reader of Palaeobiology at Bristol said: "Using Finite Element Analysis, a computer modelling technique routinely used in engineering, we were able to deduce very accurately how bite and muscle forces affected the skull of *Erlikosaurus* during the feeding process. This further allowed us to identify the importance of soft-tissue structures, such as the keratinous beak, which are normally not preserved in fossils."

Co-author Lawrence Witmer, Chang Professor of Paleontology at the Ohio University Heritage College of Osteopathic Medicine said: "Beaks

evolved several times during the transitions from dinosaurs to modern birds, usually accompanied by the partial or complete loss of teeth and our study now shows that keratin-covered beaks represent a functional innovation during dinosaur evolution."

More information: 'Edentulism, beaks and biomechanical innovations in the evolution of theropod dinosaurs' by Stephan Lautenschlager, Lawrence M. Witmer, Altangerel Perle, and Emily J. Rayfield in *PNAS*: www.pnas.org/cgi/doi/10.1073/pnas.1310711110

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