

Chilly times for Chinese dinosaurs

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Fragment of a jaw bone of a ceratopsian dinosaur, *Archaeoceratops*, from the Lower Cretaceous (Gansu province, China). Credit: Romain Amiot

Dinosaurs did not always enjoy mild climates. New findings show that during part of the Early Cretaceous, north-east China had a temperate climate with harsh winters. They explain the abundance of feathered dinosaurs in fossil deposits of that period. The discovery was made by an international collaboration coordinated by Romain Amiot of the Laboratoire de géologie de Lyon (France). Their work is published on the *PNAS* website this week.

It has long been thought that the climate of the Mesozoic, the age of the dinosaurs, was generally warm across the planet. However, a recent study challenges this theory. The work focuses on a region of north-east China where the Jehol fauna developed during part of the Early Cretaceous

(between 125 and 110 million years ago). The fossils found in this deposit include many dinosaurs covered with filamentous structures similar to bird feathers (such structures can take on various forms, ranging from filaments, down and 'protofeathers' to true feathers). But is this feature due simply to excellent conditions of preservation or to the adaptation of such species to environmental conditions? Since these dinosaurs were unable to fly, several scientists have suggested that their feathers acted as thermal insulation.



Jaw bone of a psittacosaurid dinosaur, *Hongshanosaurus*, from the Lower Cretaceous Jehol fauna (Liaoning province, China). Credit: Romain Amiot

A team of paleontologists from France, China, Japan and Thailand examined the issue and tried to determine the temperatures at that time. Teeth and bones from dinosaurs, mammalian reptiles, crocodiles, turtles and freshwater fish from fossil deposits containing the Jehol fauna were collected. This selection of samples was then completed by fossil remains from contemporary deposits in other regions of China, Japan and Thailand. The scientists analyzed the oxygen [isotopic composition](#) of each sample. They based their analysis on the principle that the average local air temperature determines the relative quantity of oxygen isotopes

contained in the rainwater drunk by the animals. This isotope record is passed on and stored within the bones and teeth of animals as they grow. Since the oxygen contained in the mineralized tissue is preserved during fossilization, the researchers were able to reconstruct the prevailing air temperatures in the environment of Asian dinosaurs during the Early Cretaceous.

The results show that average temperatures in this period of the Early Cretaceous were very similar to those of today at equivalent latitudes (such as the climate in Beijing today). The Jehol fauna therefore lived in a cool temperate climate characterized by harsh winters during which cold-blooded reptiles (turtles and lizards) had to hibernate, whereas the down, feathers and fur of warm-blooded animals (mammals, birds and dinosaurs) enabled them to maintain sustained activity in winter. "These results do not prove in any way that feathers appeared because of their insulating characteristics. They show that feathers would have given the dinosaurs of the Jehol fauna a physiological advantage over their fellow animals with scales," points out Amiot, lead author of the paper and currently a CNRS researcher at the Laboratoire de géologie de Lyon.

This work helps us to better understand the Early Cretaceous period, of which there are few geological records, and sheds new light on existing theories about the Earth at the time of the [dinosaurs](#).

More information: Oxygen isotopes of East Asian dinosaurs reveal exceptionally cold Early Cretaceous climates. Romain Amiot, et al. *PNAS*, week of 7 March 2011

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