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Is that fossil bird male or female?

UCT scientist leads team that discovers a way to identify the gender of ancient bird species

An international team of palaeontologists led by UCT's Professor Anusuya Chinsamy-Turan has discovered a way to determine the sex of a 125 million year old bird species.

Chinsamy-Turan conducted the study with Dr Luis Chiappe, Director of the Natural History Museum of Los Angeles County's (NHM) Dinosaur Institute, USA; Dr Jesús Marugán-Lobón of Madrid's Universidad Autónoma, Cantoblanco; and Gao Chunling and Zhang Fengjiao of the Dalian Natural History Museum in China.

The research was published in a paper published in *Nature communications*.

Chinsamy-Turan and the team studied hundreds of *Confuciusornis* fossils unearthed from rocks deposited at the bottom of ancient lakes in what is today northeastern China. These birds lived during the Mesozoic era when its dinosaur relatives dominated the land.

Confuciusornis specimens show remarkable differences in plumage — some had long, almost body length ornamental tail feathers, others had none — features that have been interpreted as the earliest example of avian courtship. However, the idea that male *Confuciusornis* birds had ornamental plumage, and females did not, has not been proven until now.

"Our discovery provides the first case of sex identification in an ancient bird", said Chiappe. "When people visit our Dinosaur Hall, they often want to know if the skeletons are male or female. We have nicknames like Sue and Thomas, but of all the thousands of skeletons of dinosaurs or early birds found around the world, only a few have known gender."

In this study, Chinsamy and the team found undisputed evidence of a gender difference: the presence of medullary bone.

According to Chinsamy, "Just like modern hens, female *Confuciusornis* birds that lived 125 million years ago deposited this special bone inside their long bones and then used it to make the calcium-rich eggshells." Finding such tissue — present during a short period of time in reproductively active females — in a specimen that lacked long feathers proved that those birds without ornamental plumage are females.

"This now permits us to assess gender differences in growth and development of this Mesozoic bird", said Chinsamy.

But while this discovery offers evidence that both early and modern female avian species were essentially using the same physiological strategy to reproduce, it also spotlights an important difference in when they reached sex maturity.

"Now we know that early birds began reproducing way before they were full grown, a pattern that contrasts with what we know of living birds, which typically begin reproducing after they reach full body size", said Chiappe. In that way, ancient birds produced offspring like dinosaurs, which also began to reproduce before they were fully grown.

The specimens, housed at the Dalian Natural History Museum in northeastern China, had been excavated from rocks formed at the bottom of ancient lakes in a forested environment surrounded by volcanoes. Ancient catastrophes, presumably related to volcanic eruptions, killed large numbers of birds and other animals, whose bodies were buried deep in the lake mud that helped minimize decay and preserving the organs, skeletons, and plumage.

The study of this fossil material opens a unprecedented window to understand the life-history of these primitive birds", said Marugán-Lobón. "Our study identifying the gender of *Confuciusornis* sheds much light onto the biology and physiology of early birds," said Chinsamy.

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