

Researchers place age constraints on appearance and duration of Jehol biota

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Ecological restoration map of Jeho Biota (A) and a representative fossil specimen of *Eoconfuciusornis* with exceptionally preserved feather (B). Credit: IVPP

The Jehol biota is well known for producing exceptionally preserved specimens of feathered dinosaurs, early birds, mammals, as well as insects and early flowering plants.

However, the lack of precise age constraints on the early Jehol biota hinders our understanding of the timing of key ecological differentiation and radiation, as well as their relationship with ecological processes of the Early Cretaceous terrestrial ecosystem.

Prof. HE Huaiyu's research group from the Institute of Geology and Geophysics of the Chinese Academy of Sciences (IGGCAS) placed stringent age controls on the oldest known enantiornithine and ornithuromorph birds and the early phase of the Jehol biota. They extended the temporal range of the Jehol biota to over 15 million years.

Their findings shed new light on the evolutionary radiation of the Jehol biota as well as the origins of major vertebrate groups in the Early Cretaceous.

The study was published in *Proceedings of the National Academy of Sciences* of the United States of America (*PNAS*).

According to previous studies, the chronologies of the middle and late stages of the Jehol biota have been well established.

The Lower Cretaceous Huajiying Formation of the Sichakou Basin in northern Hebei Province, northern China, contains key vertebrate taxa of the early stage of the Jehol biota. Precisely determining the depositional ages of the Huajiying Formation would advance our understanding of the evolutionary history of the Jehol biota.

Postdoctor YANG Saihong, first author of the study, conducted systematic isotopic dating for eight interbedded tuff/tuffaceous sandstone samples in the Huajiying Formation.

Their secondary ion [mass spectrometry](#) (SIMS) U-Pb zircon dates, coupled with previously obtained $^{40}\text{Ar}/^{39}\text{Ar}$ dates also by HE's group, have placed stringent age controls on the oldest known enantiornithine and ornithuromorph birds, which were the two dominant avian groups during the Mesozoic.

These radiometric ages together with the presence of a diversity of early

bird fossil lineages with drastically different morphologies indicated that by the time of the deposition of the Huajiying Formation, the bird assemblage of the early Jehol biota had already undergone a significant phase of diversification with prominent differentiation and radiation. This meant that the origin of the Enantiornithes and Ornithuromorpha is older than previously recognized.

The age of 135.4 ± 1.2 Ma of sample J08-10 in their study, which lies ~3 m above the lacustrine shale layer containing *Peipiaosteus*, dated the earliest occurrence of the Jehol biota and was also strengthened by numerous radiometric ages from the pre-Jehol Zhangjiakou Formation.

The new findings, combined with previous radiometric date of ca. 120 Ma of the late phase of the Jehol biota present in the Jiufotang Formation in western Liaoning suggested the Jehol biota has been placed between ~135 Ma and ~120 Ma. Thus, the Jehol biota lasted for at least 15 million years during the Early Cretaceous.

More information: Saihong Yang et al. The appearance and duration of the Jehol Biota: Constraint from SIMS U-Pb zircon dating for the Huajiying Formation in northern China, *Proceedings of the National Academy of Sciences* (2020). [DOI: 10.1073/pnas.1918272117](https://doi.org/10.1073/pnas.1918272117)

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