

New dinosaur fossils ignite old controversy

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Two unusual fossils unearthed recently in the geological beds of China's Liaoning province by Ji Qiang, from the National Geological Museum of China, and his team of researchers, have provided further fuel for a long-standing controversy over the evolution of birds.

Both were small theropod dinosaurs -- about the size of a turkey. But unlike other dinosaur specimens, these two, named *Protarchaopteryx robusta* and *Caudpteryx zoui* by the scientists, had feathers in the form of down. At the same time, they were incapable of flight and definitely not birds. Estimates of the age of the fossils are in dispute but later evidence indicates they are about 145 million years old.

Theropod dinosaurs, which include the tyannosaurs, were carnivorous, had small forelimbs and walked on their hind-legs. They commonly existed during the Cretaceous period about 135 million years ago. Previous studies of their stomach contents and hands show they were active predators.

The fossil indicates that *Protarchaopteryx* had feathers on its body and tail -- with a curious fan-like pattern of feathers at the end of its tail. *Caudipteryx* had primary feathers attached to one of its fingers. Its arms were shorter than those of a bird. Both fossils have down-like, vaned, and barbed feathers.

If the scientists' claim is proven correct then the feather, previously thought to be a characteristic unique to birds, actually evolved in dinosaurs. According to Ji Qiang, 'They [the fossils] represent a missing link between dinosaurs and birds, which we had expected to find.'

But there is an ongoing scientific debate over the origin of birds. Those who claim a dinosaur-origin for birds are opposed by scientists who postulate a more ancient reptilian ancestor that gave rise to both dinosaurs and birds and hence to the similarities shared by the two groups of animals.

Alan Feduccia from the University of North Carolina is the best known critic of the dinosaur-origin theory. He recently stated that feathered wings were 'the most complex appendage produced by vertebrates and it's implausible that an animal would have developed feathers if it did not fly.' He and his co-thinkers call into doubt the recent discoveries of feathered dinosaurs by pointing to the considerable difficulties in interpreting the fossil evidence.

Feduccia has discovered a fossil in China which he claims to be the oldest known example of a bird living in the same period as another primitive bird *Archaeopteryx*. His conclusion is that 'Archaeopteryx and most other early birds were a side line of avian evolution'. That is, an earlier bird-like ancestor produced a number of side-branches, which are seen in the fossil record as the various primitive birds -- one of which evolved into the modern bird.

This controversy in evolutionary biology has a long history. As early as 1860, T.H.Huxley, Charles Darwin's scientific defender, proposed that *Archaeopteryx*, which had just been discovered that year in Bavaria, was the ancestor of modern birds. This primitive bird fossil had bird-like characteristics, such as feathers and a wing, but also, atypically of birds, had a long bony tail and a toothed jaw.

Huxley noted that *Archaeopteryx*'s un-birdlike features were similar to theropod dinosaurs and drew the conclusion that the dinosaurs must have been ancestors of birds. He suggested that the small forelimbs gradually lengthened and evolved into the wings of modern day birds.

The noted English paleontologist Harry Govier Seeley disputed Huxley's claim by proposing that the similarities between birds and theropods were due to a common ability to walk on two legs -- not the result of birds evolving from dinosaurs.

In 1916, Gerhard Heilmann, a Danish medical doctor

and amateur paleontologist published 'The Origin of Birds' in which he developed on Seeley's criticisms of Huxley's theory and postulated that birds had actually evolved from an ancient reptilian ancestor. He noted the lack of any other common characteristics between theropod dinosaurs and birds -- other than walking on two feet.

Modern birds share a number of unique characteristics such as feathers, toothless beaks, hollow bones, perching feet, wishbones, deep breast bones and a stumpy tail bone. Most of these features are associated with the birds' ability to fly. For example, hollow bones serve to lighten the bird's skeleton and the stumpy tail bone gives the birds' tail feathers greater maneuverability in flight. The question that has constantly driven the various scientists for over a century is how did the distinctly bird-like features evolve?

The issue is complicated by further questions about the evolution of the feather and the likely origin of flight. Charles Darwin wrote in a letter dated 1860 to the famous botanist Asa Gray on his inability to explain the evolution of the feather: 'I remember well the time when the thought of the eye made me cold all over, but I have got over this stage of the complaint, and now small trifling particulars of structure often make me very uncomfortable. The sight of a feather in a peacock's tail, whenever I gaze at it, makes me sick!' How the feather evolved has perplexed scientists ever since.

Some scientists think that feathers may have first evolved for reasons other than flight. Paleontologist Robert Bakker of Casper College in Wyoming has suggested that a feather may have evolved in warm-blooded dinosaurs as a form of insulation. Other scientists have postulated that feathers may have been an adornment for courtship display, as is commonly found in modern birds.

Two main theories have emerged as the likely origins of flight. One is that an arboreal ancestor of birds developed the ability to glide from the trees and then evolved powered flight. The contending hypothesis is that powered flight developed from running -- that is, the extended forelimb gave the bird ancestor some lift, enabling it to run faster as it ran.

In 1973, the controversy over the evolution of birds was re-ignited in favor of the dinosaur-origin theory by

John H. Ostrom, a scientist from Yale University, who had examined the 115 million-year-old fossil of the theropod dinosaur, Deinonychus, which inhabited Montana. He noted a number of features shared between birds, including Archaeopteryx, and Deinonychus and other theropod dinosaurs -- but not with other reptiles. In other words, birds and theropods are closer in ancestry than other reptiles.

More recently discovered fossils from China, Madagascar, Spain and Argentina also lend greater weight to a dinosaur origin. Many bird characteristics have now been found in theropod dinosaur fossils. Paleontologist Fernando Novas from the Argentine Museum of Natural Science has reported a 90-million-year old dinosaur found in Patagonia that has a shoulder and upper arm that could be tucked under the body -- as birds do. Such a fossil may have been a link to the evolution of the wing.

While the latest fossil finds add further weight to the dinosaur-origin theory, the debate is not at an end. Feduccia refuses to concede that Protarchaeopteryx robusta and Caudipteryx zoui are even dinosaurs. They could, he says, be flightless birds like ostriches and emus which descended from more conventional flying ancestors.

Whatever the verdict on the current fossil finds, it is likely that the 140-year-old controversy will continue for a few years yet.

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