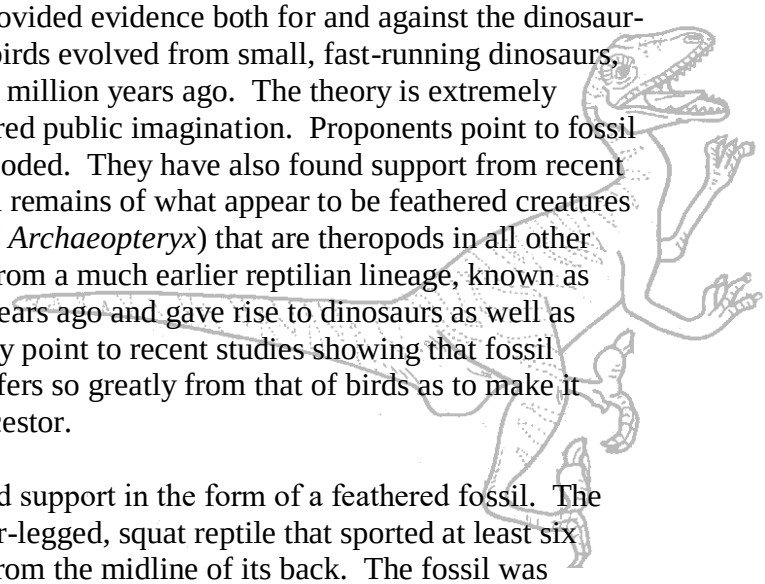
ScienceWatch – Paleontologists are Ruffled by Fossil Feathers that Contradict the Dinosaur-Origin Orthodoxy

It's happened again. Another fossil has come to light and stirred the bitter debate among paleontologists concerning the origin of birds. I highlighted this controversy when I reviewed three studies earlier in this column (Nov. '97, Dec. '97 and Dec. '98), and I will probably have more to say as new evidence is found to support one side or the other. The earlier reports provided evidence both for and against the dinosaur-origin orthodoxy, a theory stating that birds evolved from small, fast-running dinosaurs, known as theropods, which existed 150 million years ago. The theory is extremely popular among scientists and has captured public imagination. Proponents point to fossil evidence that theropods were warm-blooded. They have also found support from recent discoveries in China, which show fossil remains of what appear to be feathered creatures from 150 million years ago (the time of *Archaeopteryx*) that are theropods in all other respects. Critics argue that birds split from a much earlier reptilian lineage, known as thecodonts which existed 230 million years ago and gave rise to dinosaurs as well as pterosaurs and modern crocodiles. They point to recent studies showing that fossil theropod limb and lung architecture differs so greatly from that of birds as to make it impossible for theropods to be their ancestor.



This time it's the critics who have found support in the form of a feathered fossil. The four or five inch-long animal was a four-legged, squat reptile that sported at least six pairs of vaned appendages protruding from the midline of its back. The fossil was excavated in 1969 in Kyrgyyzstan, a former Soviet republic. The fossil impressions now believed to be feathers were first identified as reptilian scales. That feature provided a name, *Longisquama* (long scale) *insignis,* and the impressions were relegated to a Moscow drawer. They were put on display last year as part of a Russian tour in the U.S. where they caught the eye of two American paleontologists, Terry Jones and John Ruben from Oregon State University. They are two of the scientists who wrote the report on lung structure mentioned earlier. They thought the impressions could be feathers so they enlisted the aid of other paleontologists and ornithologists in determining whether or not the impressions originally assumed to be scales were really feathers.

Writing in the journal *Science* for June 23, 2000, they say the appendages are feathers. To support their conclusion they note that each appendage has a central shaft, which bears barbs that appear fused at the edges. Each shaft has a wide hollow, tubelike base similar to the calumus, the hollow base of modern feathers. According to the authors this last feature, only found in association with avian feathers, is proof; that the structures are the earliest feathers. The feathers could be held horizontally to the body and may have been used for gliding.

Critics are crowing because this animal was a thecodont, living 220 million years ago, long before theropods existed, and even predating dinosaurs. In fact, if these structures were truly feathers they would be the oldest known to exist, beating *Archaeopteryx* and the fossil discoveries in China by over 70 million years. Most scientists agree feathers

arose only once, so *Longisquama* would get the prize by virtue of its age, and feathered theropods then become a minor evolutionary dead-end branch, the critics contend.

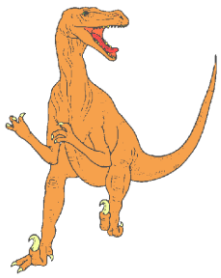
This causes loud squawking among paleontologist supporting the dinosaur-bird theory. They attack the critics for not playing by the rules. Specifically, they say the critics ignore computer-generated family trees called cladograms. The cladograms provide possible evolutionary links by comparing anatomical features that change among different groups. By using computers to make comparisons, they determine the least number of changes needed to go from one group to another, and in this way they form a family tree. Paleontologists have generated dozens of cladograms that put birds in a direct lineage from theropods.

In contrast, the critics look to one or another feature that seems to negate the lineage without producing any cladograms. Accordingly, Jones, Ruben and others have claimed that at least one of the feathered theropod fossils from China, *Caudipteryx*, was not a feathered dinosaur at all, but a flightless bird because it has certain special features.

Writing in the journal *Nature* for August 17, 2000, they contend that *Caudipteryx* possessed hind limb proportions and a center of gravity much like flightless birds and unlike any other bipedal theropod. They argue that these features make it likely that, rather than being a dinosaur on its way to becoming a bird, *Caudipteryx* was already a bird that became flightless. This fits in with their contention that theropods are not running birds, but only resemble them superficially because each developed bipedal locomotion from two separate lineages, a process known as convergent evolution.

The two schools of thought even differ as to why they think flight evolved. Dinosaur-bird proponents support the cursorial theory, which says that feathered structures helped running dinosaurs leap into the air to catch flying insects. Critics maintain that it would be impossible for bipedal running to get any theropod off the ground. Instead, they say that small, four-legged arboreal thecodonts gained a great advantage when they developed feathered appendages, which allowed them to glide from tree to tree. One thing is certain.

No matter how or why they evolved, feathers will continue to fly whenever these scientists get together.



Saul Scheinbach