

## Fossil With Signs of Feathers Is Cited as Bird-Dinosaur Link

By JOHN NOBLE WILFORD

Paleontologists have discovered in China a fossil dinosaur with what are reported to be clear traces of feathers from head to tail, the most persuasive evidence so far, scientists say, that feathers predated the origin of birds and that modern birds are descendants of dinosaurs.

Entombed in fine-grained rock, the unusually well-preserved skeleton resembles that of a duck with a reptilian tail, altogether about three feet in length. Its head and tail are edged with the imprint of downy fibers. The rest of the body, except for bare lower legs, shows distinct traces of tufts and filaments that appear to have been primitive feathers. On the backs of its short forelimbs are patterns of what look like modern bird feathers.

Other dinosaur remains with



what appear to be featherlike traces have been unearthed in recent years, but nothing as complete as this specimen, paleontologists said. Etched in the rock like a filigree decoration surrounding the skeleton are imprints of where the down and feathers appear to have been.

The 130-million-year-old fossils were found a year ago by farmers in Liaoning Province in northeastern China. After an analysis by Chinese and American researchers, the fossil animal was identified as a dromaeosaur, a small fast-running dinosaur related to velociraptor. The dinosaurs belonged to a group of two-legged predators known as advanced theropods.

The findings are described in the journal *Nature* today by the discovery team led by Dr. Ji Qiang, director of the Chinese Academy of Geological Sciences in Beijing, and Dr. Mark A. Norell, chairman of paleontology at the American Museum of Natural History in Manhattan. The specimen, on loan from China, went on display yesterday at the museum and is to undergo CAT scans here.

"This is the specimen we've been waiting for," Dr. Norell said in a statement. "It makes it indisputable that a body covering similar to feathers was present in nonavian dinosaurs."

These forelimbs were too short to have supported wings, Dr. Norell said in an interview, and so it

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Top, Mick Ellison/American Museum of Natural History; above, *Nature*

Rendering of 3-foot-long dromaeosaur and top of head with fibers.

## Fossil Has Signs Birds Are Linked to Dinosaurs

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was flightless. But some of bone structure — notably the furcula, or wishbone, and the three forward-pointing toes — bears similarities to that of birds. Other recent discoveries of birdlike dinosaurs and dinosaurlike birds have encouraged support for the theory of a dinosaur-bird ancestral link.

But a few dissenters, particularly ornithologists, continue to dispute that. They argue that birds evolved from some earlier, yet undiscovered, reptile. The critics said previously found fossils associating featherlike traces with dinosaur skeletons were too mixed up to determine whether the feathers belonged to the dinosaur and not to a primitive bird buried about the same time.

Those dissenters said the marks that were being interpreted as feathers in the new fossil could be impressions from the dinosaur's skin.

The Chinese and American researchers said the new find enabled them to see with microscopes how the feathers and downy fluff were attached to the body. A similar, though not as complete, fossil find reported last month by another Chinese-American team, including Dr. Richard Owen Prum, a paleontologist at the University of Kansas who specializes in bird fossils, appeared to reinforce the conclusion that some theropod dinosaurs indeed had feath-

### A Call for AIDS Superfund

ABUJA, Nigeria, Thursday, April 26 (Reuters) — Declaring the battle against AIDS his "personal priority," Secretary General Kofi Annan of the United Nations proposed a global superfund today to halt and reverse the disease, which kills 2.8 million people a year.

His plan, outlined in a statement at an African summit meeting here, calls for financing from rich countries and private contributors, but the plan also demands that poor nations give priority in their budgets to comprehensive health systems. The estimated cost for such a system would be \$7 billion to \$10 billion annually, compared to the \$1 billion currently spent in developing countries.

Africa is home to more than 70 percent of the world's 36 million H.I.V.-positive people.

ers.

Accordingly, most paleontologists consider the case for such a dinosaur-bird link now virtually airtight. Dr. Hans-Dieter Sues, a dinosaur paleontologist at the Royal Ontario Museum in Toronto, said the two discoveries from Liaoning Province "further strengthen the case for the theropod-bird connection, but also establish that feathers originated and eventually diversified in nonflying nonavian theropod dinosaurs."

Not that these particular dinosaurs were ancestors of birds. But they may be descendants of the ancestors. Some dromaeosaurs evolved earlier than birds. Feathered flightless birds are known to have existed as early as the 145-million-year-old *Archaeopteryx*, found in Germany in the 19th century.

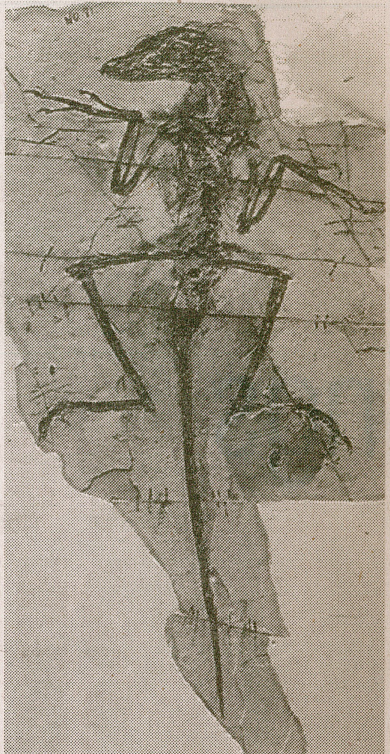
Dr. Norell said the feathered fossil showed that there was "a more general distribution of feathers than in birds alone." Studying theropods that lived later than the first birds, he explained, should provide insights into bird evolution, just as related "chimps and gorillas and lemurs help us understand human evolution."

In a commentary that accompanied the journal report, Dr. Sues wrote that because feathers have to have been present before the origin of birds and flight, they "clearly evolved for some purpose other than flight, perhaps thermal insulation or behavioral display (or both)."

The Chinese and American researchers favored the idea that the feathers served to keep the dinosaurs warm. In that case, the discovery seemed to support the theory that some predatory dinosaurs were warm blooded like modern birds rather than cold blooded like other reptiles.

They would have thus required something like feather covering to maintain their body temperature. "Insulation implies higher metabolic rates than for the average reptile," said Peter Makovicky, a paleontologist at the American Museum who is completing Ph.D. studies at Columbia and has made a detailed study of the specimen.

The region where the skeleton was found has some of the world's richest fossil beds, and they have been actively explored over the last decade. From 145 million to 120 million years ago, the land was covered by many lakes, and erupting volcanoes rained down fine ash. That probably buried



Reuters

130-million-year-old dromaeosaur fossil on display at the American Museum of Natural History.

animals as soon as they died, increasing the chance of their remains fossilizing and surviving the ages.

Two other dromaeosaurs have been recovered from those fossil beds. One, *Sinornithosaurus*, a small dinosaur was first described in 1999, and *Microraptor*, the smallest known theropod, was found last year.

But one specimen, reported in the early 1990's, turned out to be a hoax, a clever composite of bones and some featherlike imprints.

Researchers said they were sure that the latest find was genuine. The skeleton was embedded in two slabs sliced from the mudstone. Close examination, the scientists said, show that both sides "match up perfectly," a state that would be extremely difficult to fake.

The new find, Mr. Makovicky noted, appears to have been a juvenile. Its oversized head, relative to its body, suggests that the animal was not fully grown.

Although most of the skeleton's covering appears to be down or filaments, suggesting primitive feathers, the forelimbs had traces of feathers with a herringbone pattern, similar to those found in bird feathers.

If nothing else, Dr. Norell said, the discovery "shows us that advanced theropod dinosaurs may have looked more like weird birds than giant lizards."