

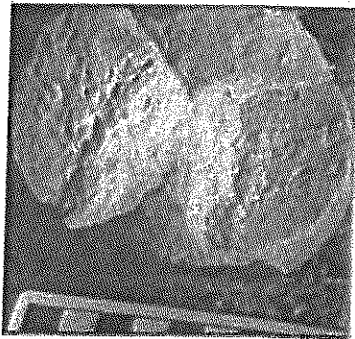
StepRead Level 990

## Unearthing Pterosaurs

*This StepRead is based on an article provided by the American Museum of Natural History.*

There is a place in the northeast part of Brazil where few people live. In this beautiful but dry area it can be hard for farmers to grow crops. But the ground there provides something else: fossils. Among these bones are some rare finds, including 23 species of extinct flying reptiles called pterosaurs.

Over thirty years ago, someone who lived there found some large pterosaur bones. He gave them to the National Museum of Brazil, where they were put away in a drawer. Many natural history museums have lots of unexamined fossils waiting to be studied because there are just too many to go through. But a few years ago, a scientist named Alexander Kellner examined some of the fossils at the National Museum. Kellner is a paleontologist, a scientist who studies things that lived a long time ago. He looked at the bones that had been in the drawer for more than thirty years.



© Alexander Kellner

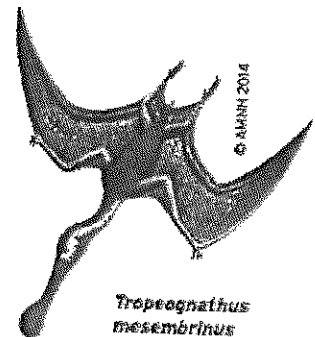


© Alexander Kellner

Round lumps of rock called nodules were found in a layer of earth in Brazil. Here, calcium collected around dead plants and animals that sank into the mud. Sometimes a hard shell of calcium formed around them. These rocky coverings preserved fish, plants, and even entire pterosaurs.

Before studying the bones, Kellner had to dissolve the lumps of rock around them. He did so by putting the fossils into buckets of acid. Using a special hammer, skilled workers at the museum freed a part of the animal's skeleton from the rock.

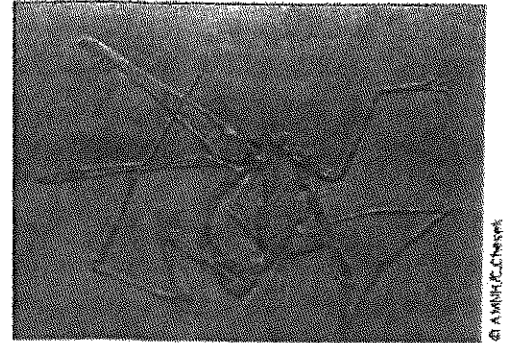
This piece of skeleton included some of the animal's skull, complete with a bony crest at the tip of its nose. It also included part of the pelvis, vertebrae, arm, and wing-bones. The wingspan of this pterosaur was almost 27 feet! It was the largest pterosaur ever found south of the Equator.



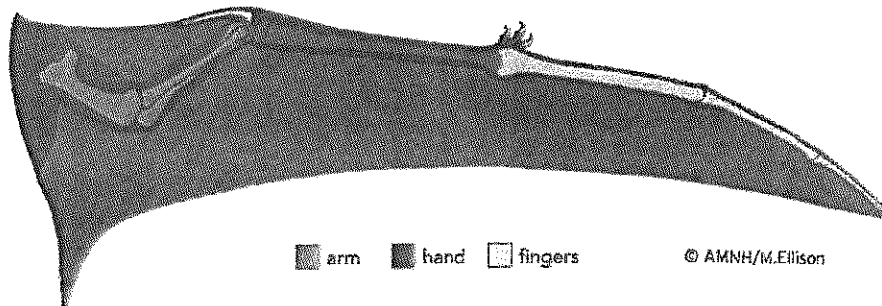
*Tropeognathus  
mesembrinus*

## Not a Bird, Not a Dinosaur

What is a pterosaur? It sounds like a simple question. But the answer wasn't obvious when the first pterosaur skeleton was discovered. That discovery happened in Germany in the 1700s. People at the time had different theories about pterosaurs. Perhaps their long skinny arm-and-finger bones were for swimming. Or were pterosaurs some kind of toothed, clawed, winged bird? Or were they mammals? In 1801 a scientist named Georges Cuvier examined drawings of the pterosaur skeleton and determined that it was a flying reptile. This was the first time a species of flying reptile had ever been recognized. Cuvier later named the animal a ptero-dactyle, which means "wing finger" in the Greek language. Its wings were made up of a shortened upper-arm bone, along with a much longer fourth finger that probably supported a wing membrane (see illustration). Even after the examination of the drawings, scientists kept debating what pterosaurs were like.



At first people wondered why the front limbs of the animal in this fossil were so long. Later the animal was identified as a flying reptile. It was named ptero-dactyle. Ptero-dactyle means "wing finger."



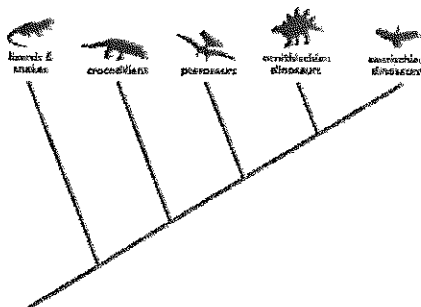
Adaptations allowed pterosaurs to fly. One adaptation was a lengthened fourth finger of the hand that developed to support a wing. Other adaptations were hollow bones that could bend and membranes between different parts of the body.

Since that time, the fossils have revealed more about these extinct reptiles. They lived more than 66 million years ago, disappearing at the same time as large dinosaurs in a mass extinction event.

Although pterosaurs may often be grouped with dinosaurs in children's picture books, they are not dinosaurs. Dinosaurs have a set of body structures that pterosaurs don't have, including a hole in the

hip socket. However, most scientists now agree that pterosaurs are more closely related to dinosaurs than to any other group. The next-closest relatives of pterosaurs are crocodiles.

Pterosaurs were the first vertebrates to fly. This was an amazing achievement. Tiny, invertebrate insects had long since taken flight, but nothing as large as a four-legged vertebrate had attempted such a thing.



This diagram shows that pterosaurs were more closely related to dinosaurs and birds than to crocodiles. But pterosaurs were less closely related to reptiles such as lizards and snakes than to crocodiles.

“They are the most fabulous creatures that ever existed! I am not exaggerating,” says Kellner. “They made the first attempts among vertebrates to conquer the air -- they were the first to develop powered flight.” Powered flight is the type of sustained flight that evolved again later in birds and bats.

Still, many mysteries remain. What type of material covered the skin of pterosaurs? Was it hair, feathers, or something in between? What did they eat, and how did they hunt? Many pterosaurs had flesh-and-bone crests on top of their skulls. These crests were dramatic anatomical features whose purpose is still debated by paleontologists.

Unlike dinosaurs, whose living descendants are modern birds, pterosaurs left no heirs when they disappeared from Earth. That means there are no animals alive today similar enough to pterosaurs for scientists to study in order to figure out how pterosaurs may have behaved. Even so, there has been new interest in studying pterosaurs over the past 10-20 years. One reason for this interest is that new methods of examining fossils have become commonplace, including the use of UV lighting and newer scanning technology. These methods allow scientists to see details they were unable to see before. Another reason for this new interest is that scientists are now sharing data digitally. They are also finding new fossils in previously unexplored places, including China and Brazil.

### Fossils Reveal Diversity

Pterosaur bones have been found on every continent. All pterosaurs have the same basic wing anatomy -- their upper-arm bone and lengthened fourth finger form the supporting part of the wing membrane. However, their wing shapes are quite diverse. They may be long, thin soaring wings like those of the large albatross bird. Or they may be short, stubby wings that might have allowed for more frequent flapping flight, like that of smaller birds such as cardinals. Some early pterosaurs had

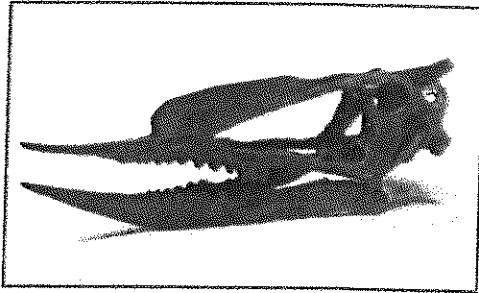
teeth that looked like pegs, as seen in living reptiles. Many others were toothless. Early pterosaurs often had long tails that they might have used to steer in the air, but later species had a short tail or no tail at all.

### Crazy Crests

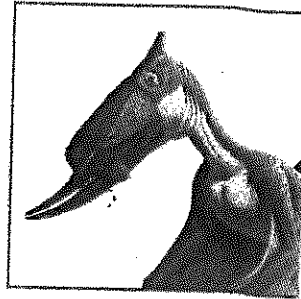
The pterosaur's head crest was a mysterious and interesting feature. It's also a great example of the incredible diversity of pterosaurs.

Like the comb on a rooster's head or the frill on some lizards' necks, pterosaur crests were anatomical features that stood out and were found across many species. But rather than flesh or feathers, these reptiles' crests were made at least in part of bone. That's helpful to scientists, as hard bone tends to be preserved as a fossil. Some pterosaur crests may also have been made up of horn-like material. Sometimes the thin bony structure underneath supported wide membranes. Almost all pterosaurs are thought to have had these crests. The crests appear in many groups of pterosaurs from different prehistoric periods. The biggest and most dramatic crests appeared right before the pterosaurs became extinct. That is also when the biggest pterosaurs lived.

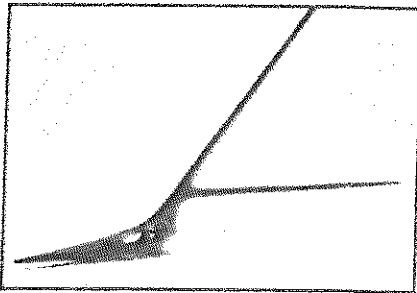
Among pterosaur species known to have had crests, there is an amazing range of shapes and sizes. For example, one species named *Pteranodon sternbergi* had a high upright crest on its skull. Another species, named *Pteranodon longiceps*, had dagger-shaped blades at the back of its head. The species known as *Nyctosaurus* had fan-like structures at the back of its head. *Dsungaripterus weii* had two crests: a long, low crest on its snout and a short crest rising above the back of the head. The *Anhanguera* species had rounded disk shapes on both upper and lower jaws. *Gnathosaurus* pterosaurs had long, low ridges running down the middle of their heads. The species known as *Tupandactylus imperator* had huge sail-like extensions that dwarfed the rest of its head.

*Dsungaripterus weil*

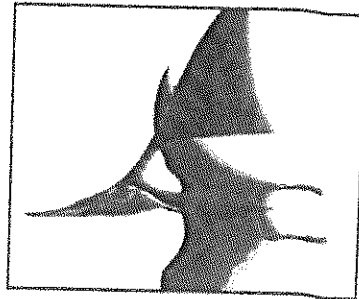
© AMNH/C.Chesek



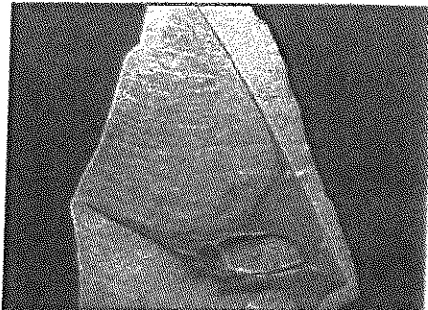
© AMNH 2014

*Nyctosaurus gracilis*

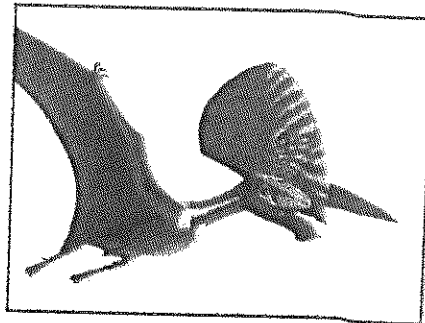
© AMNH/C.Chesek



© AMNH 2014

*Tupandactylus imperator*

© AMNH/C.Chesek



© AMNH 2014

Could something so flashy only be for show, instead of having a useful purpose? Growing and carrying around the heavier crests used up a lot of the reptiles' energy. If the crests weren't useful, they would probably have disappeared over millions of years of evolution. So what was their use? Scientists who study pterosaurs are still asking that question.

There are different theories about the purpose of the crests. Many people think that the crests provided a way for different species of pterosaurs to identify each other. Another possibility is a role in maintaining a certain body temperature. A third possibility is that crests played a role in sexual selection, which relates to the way animals choose their mates. Perhaps crests helped pterosaurs steer while flying. Or perhaps they kept the reptile stable in water as it dove or skimmed for food. The

discovery in Brazil of very different crests among closely related species of pterosaurs makes the theory of species identification seem more likely. A distinct crest would have allowed a pterosaur to recognize its own kind and to rule out others.

Were the crests as brightly colored as they are in illustrations? Scientists cannot know for sure, but light and dark bands of color on the preserved tissue of a pterosaur crest found in China make scientists think that crests might have been brightly colored, especially if they served to communicate identity or attract mates.

Still, with relatively few fossils and no living descendants for comparison, complete proof has been hard to find -- so far.